UNITED STATES AIR FORCE
RESEARCH LABORATORY

SURVEY OF
COCKPIT/CREW RESOURCE MANAGEMENT
FOR F-16 PILOTS

Merrill R. Karp

Arizona State University East
7442 East Tillman Avenue
Mesa AZ 85212

David Condit, Captain, USAF

Robert T. Nullmeyer

Air Force Research Laboratory
Warfighter Training Research Division
6030 South Kent Street, Bldg 561
Mesa AZ 85212-6061

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AIR FORCE MATERIEL COMMAND
AIR FORCE RESEARCH LABORATORY
HUMAN EFFECTIVENESS DIRECTORATE
WARFIGHTER TRAINING RESEARCH DIVISION
6030 South Kent Street, Bldg 561
Mesa AZ 85212-6061

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ROBERT T. NULLMEYER
Project Scientist

DEE H. ANDREWS
Technical Director

JERALD L. STRAW, Colonel, USAF
Chief, Warfighter Training Research Division

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David Condit
Robert T. Nullmeyer

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7442 East Tillman Avenue
Mesa AZ 85212

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This inquiry was undertaken to examine how F-16 fighter pilots viewed the Air Force emphasis on Cockpit Resource Management (CRM), the breadth and depth of CRM skills and behaviors and their applicability to the "single-seat fighter community," potential changes to CRM training, and the pilots' dominant learning style. This qualitative research was conducted with the 56th Fighter Wing at Luke Air Force Base AZ, where extensive interviews were conducted with 36 F-16 pilots from three different squadrons. Pilots were also queried about their preferred modes of learning. The conclusions and recommendations in this research highlight what potential enhancements and modifications could be made to CRM training programs to maximize the acceptance of the training, as well as improve the effectiveness of single-seat fighter pilots' CRM skills within their flights and mixed-force operations.

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SURVEY OF COCKPIT/CREW RESOURCE MANAGEMENT
FOR F-16 PILOTS

INTRODUCTION

The goals of U.S. Air Force Cockpit/Crew Resource Management (CRM) training, as defined by Air Force Instruction 11-290, Cockpit/Crew Resource Management Training Program, are to maximize operational effectiveness and combat capability and preserve personnel and material resources. CRM training provides crewmembers with performance-enhancing knowledge and skills tailored to fit the unique characteristics of each primary mission and covers six core behaviors: Situational awareness, crew coordination/flight integrity, communication, risk management/decision making, task management, and mission planning/debrief. While CRM training appears to be readily accepted by Air Force aviators who fly multicrew aircraft, including two-seat fighter aircraft, there are variances among single-seat fighter pilots in the perception of the applicability of CRM training in their environment. These perceptual differences are highlighted by the fact that single-seat fighter aircraft do not have "crews" per se but rather operate in "flights" of individual aircraft, each with a single pilot, to accomplish their mission through a mutually supporting effort.

This inquiry was undertaken to examine how F-16 fighter pilots viewed the Air Force emphasis on CRM, the breadth and depth of CRM skills and behaviors and their applicability to the "single-seat fighter community," potential changes to CRM training, and the pilots' dominant learning style. This qualitative research was conducted with the 56th Fighter Wing at Luke Air Force Base AZ, where extensive interviews were conducted with 36 F-16 pilots from three different squadrons. Pilots were also queried about their preferred modes of learning. The conclusions and recommendations in this study highlight what potential enhancements and modifications could be made to CRM training programs to help maximize the acceptance of the training, as well as improve the effectiveness of single-seat fighter pilots' CRM skills within their flights and mixed-force operations.

Background

Cockpit/Crew Resource Management for single-seat fighter aircraft is a relatively new approach to solving an old problem: How can aviators make the most effective use of all available resources--physical assets and personnel. CRM training involves a focus on aviation human factors. Inadequate training in aviation human factors, that is, incomplete situational awareness; fixation and distraction; weak inter- and intra-flight communication; poor crew coordination and flight integrity/discipline; and inadequate mission planning/debriefing, risk management/decision-making, and task management, has caused numerous lost lives and accidents which could have been prevented.

In the early 1980s, Cockpit Resource Management was introduced into the aviation arena, at first mostly in the airlines. Commercial-aviation CRM started out centering on personality variables, attitudes, and management styles. Noted aviation human factors researcher Robert

Helmreich characterizes the development of CRM as occurring over five generations, to date. Prior to 1980, crew coordination was traditionally focused on the individual pilot and reviewing accident reports for ways to improve flight operations. In the early 1980s, first-generation "Cockpit Resource Management" started a shift toward measuring the pilot's "attitudes" against an ideal standard, as an improvement vehicle. By the mid-1980s, second-generation CRM brought the entire flight deck into the process with an emphasis on cockpit group dynamics, along with a name change to "Crew Resource Management." During the early 1990s, third-generation CRM incorporated all of the organizational personnel into the process (flight crews and maintenance, etc.), while stressing team-building skills to enhance performance. By the mid-1990s, fourth-generation CRM widened the focus to bring the entire team under the CRM umbrella (pilots, support, maintenance, air traffic controllers, etc.) and to emphasize procedural integration by adding specific "behaviors" to their checklists. The goal of fourth-generation CRM was to assure that decisions made and actions taken, even in nonstandard situations, were the results of making human factors and CRM an integral part of all flight training. (Personal communication with Helmreich, in Spiker, Tourville, Silverman, & Nullmeyer, 1996; Helmreich, Merritt, & Wilhelm, 1999). The breadth of CRM training has continually grown to include communication, situation awareness, decision-making, and other human factors. A recent aim of CRM training has been to examine error chains and explore strategies to manage error. The fifth generation of CRM unfolded in the late 1990s for the new millennium with the perspective that since "human error" is inevitable; it is therefore a valuable source of information. Accordingly, CRM can be viewed as exercising a set of error management countermeasures: first, to avoid the error; second, to trap an error before it can be committed; and third, to mitigate the consequences of an error that does occur and was not trapped (Helmreich, Merritt, & Wilhelm, 1999). Current research also accentuates that learning must be a continuous process over time to be effective and stresses the importance of incorporating cognitive psychology models in team building training programs (Ilgen, 1999).

In the U.S. military, the scope of CRM evolved from an emphasis on the aircraft commander, to training that is applicable to active inclusion of all flight and crewmembers. The Air Force embraced CRM and in 1994 issued Air Force Instruction 36-2243, Cockpit/Crew Resource Management Program, which established the requirement for developing and managing tailored, mission-specific CRM training. In 1998, Air Force Instruction (AFI) 11-290 replaced AFI 36-2243 as the Air Force's instruction on CRM for flying operations. Each Air Force major command is responsible for supplementing the Air Force instruction by creating its own specific training for its individual aircraft and missions. Air Combat Command (ACC), Air Education and Training Command (AETC), the overseas commands--United States Air Forces Europe (USAFE) and Pacific Air Forces (PACAF), and the Air Force Reserve and Air National Guard fighter units all have significant fighter CRM training requirements in the Combat Air Forces (CAF). This situation creates the potential for variances in the CRM training received in the different major commands.

Specific Research Objectives

The primary purpose of this research was to gain an understanding of single-seat fighter pilots' attitudes toward CRM training, with a long-term objective of using the data to enhance CRM training for the fighter community. Single-seat fighter pilots' attitudes toward CRM and

learning styles were explored by interviewing a representative sample of F-16 pilots at Luke AFB.

The overarching research question in this inquiry was "What enhancements to single-seat fighter pilot Cockpit/Crew Resource Management training programs could improve the pilots' understanding and acceptance of CRM training, with the goal of improving their long-term retention and application of CRM training?"

The analysis of the data from the interviews also included an examination of the perceived attitudes and needs of the single-seat pilots. Additionally, a component of the inquiry was to examine the learning styles of the F-16 pilots, in an attempt to determine the most reinforcing format for CRM training. Also, a composite, integrated CRM training model is suggested to enhance training retention and application.

Organization of Report

The remainder of this report is presented in three major components. The first component will detail the methodology used to conduct the qualitative research involving F-16 pilot interviews. The second section examines the interview findings, and includes examples of the most significant interview comments that fall under the following topical subjects:

1. **Formal CRM training.** Presence or absence of previous CRM training is explored, along with an assessment of the quality of training (neutral or mixed experience, strongly positive experience, or less than positive experience) of selected training components.

2. **Attitudes toward F-16 CRM training program.** Attitude assessment topics include: F-16 pilots who feel that they are already doing CRM; F-16 pilots feel that they are being "forced" to do CRM training; use of the term "CRM" is not a common or desired point of reference for F-16 pilots; F-16 training should focus on single-seat, not multicrew aircraft; USAF needs to show that it is serious about CRM; other positive responses, and other negative responses.

3. **Suggestions to improve CRM training.** Respondents' suggestions are categorized under: Make all CRM training tactically relevant, make CRM training applicable to single-seat fighter pilots, consider using another term other than "CRM" for single-seat fighters, assure course delivery is applicable to audience, assure concept of training (format, duration, frequency, etc.) enhances learning process, leadership must support training, use of simulators to reinforce training, do not force training to be accomplished, CRM instructors must have credibility, and general comments.

The third component provides overall interpretations and conclusions from the research, and proposes recommendations for enhancing single-seat fighter Cockpit/Crew Resource Management training programs.

Appendix A details each of the respondents by an identification number. Appendix B outlines the respondents by pilot category (instructor, student, or leader), and Appendix C summarizes the respondents by their experience in different types of aircraft. Appendix D is the

Consent Form for the Interviews. Appendix E is the Interview Worksheet. Appendix F contains the complete interview responses--the number in parentheses following the comment indicates which respondent(s) made the comment. Appendix G contains responses to other interview questions on CRM behaviors and single-seat fighter flight operations which were not included in their entirety in the findings and interpretation sections but which still offer a rich narrative with which to examine and understand single-seat fighter pilots' attitudes toward Cockpit/Crew Resource Management.

METHODS

Participants

Extensive interviews were conducted with 36 F-16 pilots from three different squadrons at the 56th Fighter Wing, Luke AFB, AZ. These pilots represented three groups: F-16 instructor pilots (n = 14), F-16 student pilots (n = 11), and squadron and wing leaders (n = 11).

Interview Content and Structure

Interview questions (Appendix E), in an open-ended format, were used to initiate and facilitate the interview process. Questions were written in two forms: general questions providing the overall structure for the interviews, and subquestions to narrow the focus and to provide the ability to probe the informants responses in selected, specific areas. Questions were designed to support anticipated data analyses which included: (a) "open coding" to determine categories based on the responses of F-16 instructor pilots, F-16 student pilots, and F-16 leaders; and (b) "axial coding", which looks at the comparisons and interrelationships of the F-16 pilots in regard to CRM.

The research employed qualitative research techniques where the common respondent topics and links, foundational theory, and hypotheses are allowed to evolve during the on-going data collection and analysis without preconceived hypotheses (Creswell, 1994). The goal was to provide behavioral and attitudinal data points from the single-seat fighter community that would facilitate modifications to enhance CRM training.

Participants were first asked to provide demographic information (flight experience, position within the Air Force, etc.). Pilots were then queried about their preferred modes of learning, with an objective of improving academic, simulator, and flight training. CRM-specific questions addressed exposure to formal CRM training and reactions to that training, integration of CRM principles into everyday operations, instructors' attitudes of students' understanding of CRM or students' attitudes regarding instructors' and evaluators' use of CRM, and recommendations for improving CRM training for F-16 pilots.

Data Collection Procedures

Each interview lasted approximately one hour and involved two researchers. The principal investigator was a former F-16 pilot and a former fighter wing commander. This researcher, who is on the faculty at Arizona State University, conducted each of the 36 interviews. In each

interview, the principle investigator was supported by one of three other researchers. Most interviews were supported by one of two Air Force Research Laboratory members, either an active duty captain who was formerly an instructor navigator, or an Air Force civilian with substantial field research experience. For three of the interviews, a graduate student from the Arizona State University aviation program provided data collection support. The principle researcher asked all interview questions while he and the second researcher recorded responses. Some responses were recorded verbatim, while others were summarized.

The researchers had the support of the senior wing leaders who approved access to the population samples to be studied. Steps were taken to obtain permission from the F-16 wing, so that the rights of the human subjects were protected (Appendix D). The researchers recognized the sensitive nature of maintaining confidentiality of the data, preserving the anonymity of the informants, and using the research only for its intended purposes (Creswell, 1994).

Interviews were conducted in the fall and winter of 1998 and the spring of 1999. Interview sessions were continued to the point where there was a saturation of information, meaning that no new information was emerging (Merriam, 1988). Quotations, comments, and observations were written down on field notes immediately during the interviews. Researchers reviewed the notes after the session and made expanding comments as necessary.

Data Analysis

Data analysis was conducted simultaneously with the data collection. This included sorting the responses into categories, interpreting the data, and formatting the data into a reflective picture (Creswell, 1994). As the data were collected, coding was accomplished to organize the information into themes or categories for interpretation. Categories for the codes were developed after some of the initial interviews were completed and the researchers were able to cluster responses into major topics and themes. Topical codes evolved and responses were re-coded as necessary during the course of the study as more data became available and an understanding of the topical categories was refined. Interview axial coding, which reflects the interrelationships among the responses, is detailed in Appendix F for primary data collection and Appendix G for core CRM behavior data collection.

Efforts were taken during data collection and analysis to minimize bias, or prejudicial outlook, in the research findings. While bias can be introduced into a qualitative inquiry process during every phase of the research, the researchers recognized that the major potential source of bias lay in erroneously interpreting findings to be consistent with the researchers' point of view (Potts, 1990). Being aware of this pitfall, two researchers were always used to take separate notes.

To address the issue of reliability between researchers, both sets of notes for each participant were examined side-by-side. Each researcher's written notes were read and compared to those of the other researcher for each response. While some differences existed in style and nature of the recorded responses (that is, one researcher may have written a verbatim response while the other summarized the same response), content of the responses appeared to be nearly identical for most responses. Where content differed, it was not contradictory, suggesting that each

researcher may have focused more specifically on different aspects of long responses. Where these differences exist, both sets of responses have been included in the data.

FINDINGS

The interviews provided a rich narrative with which to examine and understand single-seat fighter pilots' attitudes toward CRM. The findings were initially open coded under the topical subjects, as outlined in the Interview Worksheet (Appendix E): CRM formal training received; overall comments on *USAF* emphasis on CRM; integration of CRM into everyday flight and simulator operations; instructors' attitudes of students' understanding use of CRM; students' attitudes of instructors' and evaluators' use of CRM; interviewees' suggestions to improve CRM training; and assessment of learning styles.

As interviews were conducted and on-going analysis performed, new response groupings, or topics, evolved. These responses were axial coded into more meaningful categories and became the basis for data reduction and findings. The axial coding for *formal CRM training* became: Neutral or mixed experience, strongly positive experience, or less than positive experience. The axial coding topics for *attitudes toward F-16 CRM training program* became: F-16 pilots feel that they are already doing CRM; F-16 pilots feel that they are being "forced" to do CRM training; use of the term "CRM" is not a common or desired point of reference for F-16 pilots; F-16 training should focus on single-seat, not multicrew aircraft; USAF needs to show that it is serious about CRM; other positive responses and other negative responses. The axial coding topics for *suggestions by respondents to improve CRM training* became: Make all CRM training tactically relevant, make CRM training applicable to single-seat fighter pilots, consider using another term other than "CRM" for single-seat fighters, assure course delivery applies to audience, assure concept of training (format, duration, frequency, etc.) enhances learning process, stress that leadership should support training, use simulators to reinforce training, do not force training to be accomplished, assure CRM instructors have credibility, and general comments.

In addition to tabulation of the axial coded data, representative interview comments are included to add depth to understanding the attitudes of the F-16 pilots. Axial coding of the data and topic selection for data reduction and the representative comments were made by the principle researcher, a former F-16 pilot and fighter wing commander, based on the researcher's twenty-five years of interaction with, and an appreciation for, fighter pilots and their unique flight environment.

Interview Topics

The first findings reported are pilots' attitudes concerning CRM formal training in undergraduate pilot training, F-16 formal course training, F-16 instructor training, F-16 continuation training, and other formal CRM training. The next findings summarized (Tables 1-7) are the respondents' attitudes toward the USAF emphasis on CRM, integration of CRM in everyday operations, instructors' attitudes of students' understanding of use of CRM, students' attitudes of instructors' and evaluators' use of CRM, suggestions by respondents to improve CRM training, and respondents' learning styles. Representative responses are included to

emphasize the depth and content of the responses; Appendix F is a complete detailing of the primary data responses. Additional responses on associated CRM subjects are in Appendix G.

CRM Formal Training

Undergraduate Pilot Training (UPT)

Table 1. UPT Training

Response	Number	Percentage
Received CRM-specific training in UPT	7	20
Did not receive CRM-specific training in UPT	28	80
No response	1	

Representative Respondent Remarks.

- At UPT at Sheppard AFB in 1993, received CRM component in prioritization and task management, but they did not know how to deal with single-seat CRM concept (8 to 12 hours).
- Total of three hours of classes: At beginning of UPT as overview, halfway through T-37s and at end of T-38s. Taught by physiology training people. Mostly general information, but were shown three films showing crashes with good and bad examples of CRM.
- In T-37s/T-38s, about 2 to 3 hours of lecture on risk assessment, CRM, and communication, using mostly videos of good and bad CRM and mishaps.

F-16 Formal Training (FT)

Table 2. F-16 Formal Training

Response	Number	Percentage
Some training	18	85.7
No training	3	14.3

Table 3. F-16 Formal Training Experience

Response	Number	Percentage
Neutral or mixed experience	10	47.6
Strongly positive experience	0	0.0
Less than positive experience	8	38.1
No training	3	14.3

Representative Respondent Remarks.

- "Classroom" at Luke, 4-hour course, in generalized physiological training and situational awareness.
- Received a briefing by safety people that was supposed to be on how CRM applied to fighters, but it really showed how "CRM is for multicrew airplanes."
- Principles in bits and pieces during training, but "not as CRM specific."
- At Mountain Home (1992), initial training was by physiology instructor. Only 10% useful and couldn't remember what was taught.

F-16 Instructor Course (I)

Table 4. F-16 Instructor Course

Response	Number	Percentage
Some training	3	30
No training	7	70
No response	3	

Representative Respondent Remarks.

- In academics at Luke we talked a little about CRM, but it was mostly a "square-filler."
- Classroom lecture by wing aviation physiologist went over case studies for about two hours.
- 1 to 1 ½ hours at Luke on common errors students will make.

F-16 Continuation Training (CT)

Total CT Training (n = 31)

Table 5. F-16 Continuation Training Experience

Experience	Total (n)	Total (%)
Neutral or mixed	18	58.1
Strongly positive	6	19.3
Less than positive	7	22.6

The representative remarks are ordered by MAJCOM, and whether the comments were neutral, strongly positive, or less than positive experience.

AETC (n = 13)

Table 6. AETC CT Responses

Experience	AETC (n)	AETC (%)
Neutral or mixed	12	92.3
Strongly positive	0	0
Less than positive	1	7.7

Representative Respondent Remarks.

Neutral (or mixed) experience (n = 12)

- CRM training in operations is integrated into daily flying activities; it is not separated as a separate subject.
- One hour of discussion using slides and videos on incidents and accidents taught by wing aviation physiologist.
- 1 to 1 ½ hours per year in squadron at Luke, given by the Academic Squadron aviation physiologist, covering incidents and accidents and the thought process that occurred. This is a "grounding item" if it is not attended.

Less than positive (n = 1)

One hour of lecture in classroom: "Everyone hated it."

ACC/USAFE/PACAF (n = 18)

Table 7. ACC/USAFE CT Responses

Experience	ACC/ USAFE (n)	ACC/ USAFE (%)
Neutral or mixed	6	33.3
Strongly positive	6	33.3
Less than positive	6	33.3

Representative Respondent Remarks.

Neutral (or mixed) experience (n = 6)

- At Mountain Home in 1995 in the ACC CRM van. First couple of times it was worthless because it had a heavy focus on multiengine CRM. But then it changed to move to more single-seat focus and fighter application and became a very good refresher. PC flight simulator was fun, but not useful.

- ACC mobile CRM Van at Shaw (twice). Worthwhile training, but it was a little long because of the day-to-day operational tempo. It drives things like shooting the gun to the weekends.

Strongly positive experience (n = 6)

- Tactical scenarios in the ACC CRM van at Mountain Home were very relevant.
- Six-hour course at Spangdahlem in CRM van in 1996. Case studies were good, but CRM or emergency training in a real simulator would have been better than the PC-based simulators in the van.

Less than positive experience (n = 6)

- *Initial* CT training at Shaw in ACC CRM van for 4 ½ hours, including a 2-hour hands-on trainer. Some of the exercises were very useful to emphasize CRM issues. However, *follow-on* CT was a waste of time for single-seat fighter pilots (except for F-15E and EF-111s) because it emphasized too much "crew coordination."
- Four hours at Holloman in ACC CRM van following a mission profile (1996). "Not very productive; I already knew that I was supposed to use all of my resources."

Other CRM Formal Training

Representative Respondent Remarks.

- The best CRM training was going through the accident investigation school at the Safety Center at Kirkland. It was heavy on human factors.
- As a former navigator, received a lot of *crew coordination* in navigator school, Holloman Weapons System Officer (WSO) lead-in, and F-4 school.
- In first F-4 operational unit in late '80s, received CRM that was applicable only to heavy, multicrew aircraft.
- Some CRM at centrifuge training on task management and psychological training (1 ½ hours).

Attitudes toward F-16 CRM Training Program

The F-16 pilots' responses to the interview questions exploring their attitudes toward CRM training were recoded to reflect common topic areas (see Table 8). Representative remarks follow to add narrative depth to the topic codings. For details of the complete responses, refer to Appendix F.

Table 8. Axial Coding of Interview Responses

Coding Area	Interview Topics						
	USAF emphasis	Integration top down guidance	Integration flight operations	Integration Simulator Operations	IP attitudes	Student attitudes	Total responses
Already doing CRM	11	4	2	-	1	-	18
Being forced to do CRM training	6	7	1	-	-	1	15
CRM not desired term	9	16	19	7	10	5	66
Need to focus on fighters	4	-	1	2	-	-	7
USAF must show it's serious	5	1	-	-	-	-	6
Other positive comments	9	6	13	18	5	2	53
Other negative comments	6	6	8	15	6	-	41

Representative Respondent Remarks

F-16 pilots feel that they are already doing CRM.

- There is a lot of resistance to CRM training because the fighter community has been doing this for years; it is just that they did not call it anything.
- We know about CRM "once in a while by hearing a buzzword, but it's really a different name for something we've already been doing."
- Fighter pilots already do CRM, and it's "common sense."
- "CRM has always been done in the single-seat world, that's why single-seat guys 'cut-up' on CRM."

F-16 pilots feel that they are being "forced" to do CRM:

- "CRM training is something that you're forced to do to fill a square."
- Very negative opinion. "It's just another one of those things we have to do; the latest management de jour."
- Principles should be applied, but no one wants another line in the briefing guide that says: "CRM."

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- It is being implemented and covered, but it's not called CRM because "CRM is for multi-crew airplanes."
- CRM is something that is aligned with a crew concept and is not applicable to single-seat fighter pilots, but "CRM concepts" are ok and applicable.
- "Never refer to CRM as 'CRM' because it will turn people off!"
- Word CRM creates "hostile" attitudes.
- Students understand the subtasks of CRM but do <u>not</u> like the term "Crew Resource Management" because they say that they are "not in a crew airplane."
- Single-seat pilots hate words with "crew" in them. They want to use pilot instead of crew, for example: pilot van vice crew van; pilot rest vice crew rest; and pilot meeting vice crew meeting.

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- "CRM is not really being addressed toward a single-seat audience."
- Effort is good, but CRM needs to be specialized for single-seat aircraft using flight communication techniques, instead of using multiplace airplanes and flight deck communication procedures.
- "Most CRM training has been focused on crew-planes, so it's not always applicable, but the single-seat guys try to translate it."

USAF needs to show that it is serious about CRM.

- "Great reluctance of the captain-on-the-street to adopt something unless they see that the Air Force is serious about implementing it."
- Not sure people know what CRM is. Some like it; some think it is bunk. There is a lack of dollars to support the CRM program, but "we talk a good game."
- The Air Force has placed emphasis on CRM, but it is not clear in the wing or squadron as to the specific direction.

Other *positive* comments.

- While people have not been responsive to CRM in the past, they seem to be getting better.
- "Formal program is a step in the right direction."
- CRM training is useful if it is done the right way and <u>not</u> just filling a square. It should be more frequent and <u>not</u> just annually.
- Mentoring is very important for the IPs to show students the importance of CRM concepts.

Other *negative* comments.

- Every two or three years, the Air Force comes up with a new "program to worship."
- You should manage your cockpit yourself; you don't need help.

- CRM is <u>not</u> integrated into simulator missions, and they should be.
- "Students come into F-16 formal training <u>too CRM oriented</u> and are too willing to speak up right away. They forget that they are in a single-seat fighter."

Suggestions by Respondents to Improve CRM Training

The F-16 pilots' suggestions to improve CRM training have been recoded to reflect common topic areas (see Table 9). The responses in Table 9 indicate the frequency of the suggestions. Representative remarks follow to add narrative depth to the topic coding. For details on the full responses, refer to Appendix F.

Table 9. Suggestion Topics to Improve CRM Training.

Suggestion	Responses
Assure concept of training (format, duration, frequency, etc.) enhances learning process	30
Assure course delivery applies to audience	22
Consider using another term other than "CRM" for single- seat fighters	20
Make all CRM training tactically relevant	13
General comments	13
Make CRM training applicable to single-seat fighters	9
Use simulators to reinforce training	7
Do not force training to be accomplished	6
Leadership must support training	5
CRM instructors must have credibility	3

Representative Respondent Remarks

Make all CRM training *tactically relevant.*

- Use tactical scenarios in training to make it interesting and keep students' minds thinking about it.
- Minimize psychological terms.
- The more the tactical relevance of the CRM principles can be applied, the better the outcome of the mission.
- Anytime you work with fighter pilots, you will have challenges. Must stress "practicality" and "relationship to mission objectives." No fluff!

Make CRM training *applicable to single-seat fighters.*

- Make it applicable to single-seat fighter pilots.
- Think of CRM from the perspective of a single-seat pilot.

- The effort is good, but CRM needs to be specialized for single-seat aircraft using flight communication techniques, instead of using multiplace airplane flight deck communication procedures.

Consider using another term for single-seat fighters other than Cockpit/Crew Resource Management.

- "CRM is a dirty word to the fighter community," don't ever refer to CRM, but just teach the subtopics.
- Change the name CRM to something that is not labeled as being from the heavy community.
- De-emphasize multicrew CRM (the genesis of CRM). The reaction of the fighter world to CRM is to "scoff" at it.
- F-16 pilots "shut off" at the use of the term "CRM." It is not for F-16 pilots since they have no crews.
- It matters what you call the training. "Do not call it CRM."

Assure *course delivery applies* to audience.

- Use of case studies of accidents is very good.
- Do not use old videos of accidents and crashes over and over to motivate.
- Have more "hands-on" training.
- Do not use big-room lectures with a lot of "concepts".

Assure *concept of training* (format, duration, frequency, etc.) *enhances* learning process.

- Have a mixture of experience in the class to keep it interesting.
- If CRM training takes too long of a time, single-seat fighter pilots will go to it with a negative attitude. "The shorter you can make continuation training (one hour desired), the better."
- CRM training is useful if it is done the right way and not just filling a square. It should be more frequent and not just annually.
- Must stress that CRM is for everything, not just emergencies and contingencies.

Leaders must support training.

- Squadron Commanders, Operations Officers, and Weapons Officers must embrace it.
- CRM issues should be covered often in briefings.
- Present it as part of normal pilots' meetings.

Use *simulators to reinforce* training.

- Use more interactive training and less classroom time. Need a PC-based, nonclassified, communications interactive, F-16 simulator for pilots to practice mission at home.

- Use video playback of simulator or training device missions that include the "communication" between the players.
- Have simulator missions specially designed for CRM with multiple roles played by the simulator instructor, off of a script, stressing interflight and external communications (SOF, etc).

Do not "force" training to be accomplished.

- "We already have enough ground duties, don't increase them."
- We do CRM already; we don't need to be trained to do it.
- Do not change things and increase the workload of the instructors by forcing them to formally do something that they have always done.

CRM *instructors* must have *credibility.*

- Must keep credible (fighter experienced) CRM instructors.
- Delivery of CRM training is very important; audience must relate to the instructor as far as background and knowledge.
- Do not have the aerospace physiologist teach CRM because they do not have the credibility to F-16 pilots. Have F-16 pilots teach F-16 pilots.

General comments.

- Keep training applicable. Use a format that "takes you out of the squadron and allows you to focus."
- CRM seems "detached from the rest of the training syllabuses; it should be integrated."
- Consider ops doing some CRM with maintenance personnel.

Assessment of Learning Styles

The way people learn best, or their *learning style*, is of considerable significance in developing and delivering successful training programs. One model suggests that there are three recognized primary, or dominant, learning styles: First, *visual learners*, who learn best by reading or looking at pictures. Second, *auditory, or aural, learners*, who learn best by listening. And third, *hands-on, tactile, or kinesthetic learners*, who need to use their hands or whole body to learn (Filipczak, 1995). In developing CRM training programs, it is important to understand how people learn the best for long-term retention and future application. Because of the depth and complexity of the subject matter, aviation instructors must present the course material in ways that satisfy the different needs and styles of aviation learners. This study assessed the learning styles of the F-16 pilots and found over half were hands-on learners, and the rest were either visual learners or a combination of hands-on and visual learners (see Table 10). The composition of this learning style breakout mirrors previous research on aviators (Karp, 1998). Of particular note is that there were no audio only learners, which is the predominant form of most lectures.

Table 10. F-16 Pilot Learning Styles.

Learning Style	Respondents (n = 36)	Percentage
Hands-on Learner	17	48.6
Visual Learner	9	25.7
Hands-on/Visual Learner	6	17.1
Visual/Auditory Learner	3	8.6
Auditory Learner	0	0
Hands-on/Auditory Learner	0	0
No Assessment Made	1	2.7

Representative Respondent Remarks

Visual Learners (n = 9, 25.7%).

- Visual, followed up by flying.
- Must see it, instead of hear it.
- If I can see a good demo or a picture, I can recreate it later.

Hands-on Learners (n = 17, 48.6%).

- I have to read a little, but I need to be hands-on to really learn.
- I am slow to learn right away, but when I touch something, my learning accelerates.
- I learn by "doing it."
- Must write or do the task to learn.

Hands-on/Visual Learners (n = 6, 17.1%).

- Hands-on for flying, visual for systems.
- Visual learner with hands-on a close second.
Visual/Auditory (n = 3, 8.6%).

- Must do both.

No Assessment Made (n = 1).

Additional Findings

While reviewing participant responses to open-ended interview questions, several high response trends were identified in the data. Frequency statistics were run on these trends to determine the valid percent of participants indicating these common responses (see Table 11). It is important to note that these trends were not specifically asked questions, but they occurred spontaneously during interviews relating to CRM core behaviors and skills. These inferences could be different if these questions were asked directly (See Appendices F and G).

Table 11. Common Primary Data and Core CRM Behavior Data Responses

Common participant response	Valid percent of participants voicing this response
Indicated that fighter pilots already use CRM principles	91
Indicated that CRM is applicable to fighters	94
Indicated that they do not like the term CRM	40
Indicated that CRM is done but is not called CRM in fighters	82
Indicated that CRM principles are important in briefing	97
Indicated that CRM principles are important in debriefing	87
Indicated that a good flight lead is characterized by: -Being a good communicator -Having good people skills -Being knowledgeable -Being a good pilot -Aggressiveness -Being a good overall leader	 58 39 33 15 15 6
Indicated that wingmen should speak up: -In flight -When issue may affect mission (including training mission) -During briefing & debriefing -For bad feelings or if uncomfortable with situation	 91 47 41 33
Preferred method for wingmen to question or non-concur with lead during flight -Plain English -Knock it off call -Ask questions -Other methods	 40 30 23 7

INTERPRETATIONS, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The research interpretations, conclusions, and implications were determined by the principle researcher, a former F-16 pilot and fighter wing commander, based on the researcher's twenty-five years of interaction with, and appreciation of, fighter pilots and their unique flight environment. In qualitative research, the success of interviews rests on the skill and experience of the investigators (Merriam, 1988). Development of these research interpretations, conclusions, and implications was derived from not only exactly "what" each respondent said and "how" they said it, but also from what the researchers assessed was their underlying "attitudes" toward the research questions.

Interpretations (from data)

CRM Training

Undergraduate Pilot Training (UPT). Only 7 of the 35 respondents indicated that they were given CRM training during UPT. A high correlation between rank (an approximation of time in the Air Force) and the respondents who stated that they had not received specific CRM training in UPT, reflects the recent introduction of CRM training over the few years (see Table 12).

Table 12. UPT Training

Response	Number	Percentage
Received CRM-specific training in UPT	7	20
Did not receive CRM-specific training in UPT	28	80
No response	1	

Potential correlation between demographic variables and common response variables were examined. Only one significant relationship was found: the relationship of rank with completion of a CRM training course during UPT ($r = .632$, $p < .01$). With relatively new pilots being given training in UPT, which the older pilots have not been exposed to, a common framework of CRM-related terms and expectations between those groups appears to be still evolving. This variance in foundational CRM formal training in UPT could contribute to some differences in attitudes toward CRM concepts and principles between the older pilots and the younger pilots. The data also revealed that formal CRM training in UPT were not consistent among the respondents with respect to either syllabus structure or content. However, newly published AETC Instructor and Student CRM lesson plans underscore a move by AETC to standardize baseline CRM training in UPT and/or Undergraduate Navigator Training (UNT).

F-16 Formal CRM Training. F-16 Formal Training (FT) CRM program mirrors the same gradual CRM knowledge evolvement experienced by UPT pilots, with the youngest pilots having received the most CRM exposure (see Tables 13 and 14).

Table 13. F-16 Formal Training

Response	Number	Percentage
Some training	18	85.7
No training	3	14.3

Table 14. F-16 Formal Training Experience

Response	Number	Percentage
Neutral or mixed experience	10	47.6
Strongly positive experience	0	0.0
Less than positive experience	8	38.1
No training	None	14.3

Until recently, expanded AETC CRM lesson plans did not exist in a format that completely aligned with the Air Force Instruction on CRM training programs, the latest being AFI 11-290, dated 14 August 1998. Consequently, without standardized direction, the FT training programs appeared to be oriented toward aviation physiology subjects, such as G-LOC and stress management, as well as some CRM subjects like problem solving, situational awareness, and aircraft incident and accident reviews. Using the new AETC Instructor and Student Guides, P-V4A-A-C-CR-IG, March 1998, as a baseline upon which to build, FT CRM training can be expanded.

F-16 Instructor CRM Training. While instructor CRM training must cover a broad spectrum of academic and flying skills, it does not appear to have a consistent component which focuses on teaching instructors to recognize or correct shortfalls in the students' understanding of, or implementation of, CRM behaviors and skills (see Table 15).

Table 15. F-16 Instructor Course

Response	Number	Percentage
Some training	3	30
No training	7	70
No response	3	

If the instructors are to carry the responsibility of assuring that CRM skills and behaviors are a part of every flight and simulator, then the instructors should have continual CRM refresher training to highlight recent innovations and developments in CRM and aviation human factors.

F-16 Continuation Training. Major commands individually administer CRM CT training programs. AETC and PACAF support CT with in-house resources, while ACC and USAFE provide this support through a contractor. The F-16 pilots' experiences with the commands' training were varied (see Table 16).

Table 16. Continuation Training

Experience	AETC (n)	AETC (%)	ACC/ USAFE (n)	ACC/ USAFE (%)	Total (n)	Total %
Neutral or mixed	12	92.3	6	33.	18	58.1
Strongly positive	0	0	6	33.3%	6	19.3
Less than positive	1	7.7	6	33.3	7	22.6

Many F-16 pilots who attended the ACC and USAFE CRM training programs liked the case studies with interactive computer-based training, but did not like the PC-based situational trainer. The tactical relevance of the training and applicable scenarios were very high on the respondents' priorities. Experience and credibility of CRM instructors were also very important.

Other CRM Training. CRM training has been conducted in various formats by organizations across the Air Force; however, prior to the issuance of AFI 11-290 and its predecessor AFI 36-2243, there had not been an effort to develop an overarching CRM training program.

Summary Interpretation of CRM Training. Currently, each major command is responsible for developing its own CRM program. Consequently, there have been variances in content and magnitude of CRM training that pilots receive in UPT, formal training, and continuation training in the operational units. These training programs, which may differ in delivery format and subject matter, present an environment in which pilots may understand CRM skills and behaviors from different perspectives and to different retention and application levels. Moving between major commands could also result in negative learning. Additionally, pilots who have recently gone through UPT and initial weapons systems training have more formal CRM training than pilots who have been in the Air Force longer. This could create a situation where the "older" pilots, including instructors and flight leaders, do not view CRM behaviors and skills with the same perspective as the "younger" pilots.

Attitudes Toward F-16 CRM Training Program

Pilots' "perceptions" about CRM appeared in some cases to be an obstacle to adoption of CRM principles in the broadest context (see Table 17). The F-16 pilots interviewed displayed a high enthusiasm for their mission and an in-depth knowledge of fighter operations. However, many pilots did not indicate a full understanding of the breadth of the Air Force CRM program, or the value of CRM training to enhanced combat readiness and effectiveness. Many experienced single-seat F-16 fighter pilots felt that they had "always done CRM." They generally did not like the term "CRM" because of multicrew airplane connotations. Many pilots thought CRM focused on multicrew aircraft. Some pilots indicated they wanted the USAF to show it was serious about CRM training by funding it adequately and assuring that CRM training was specialized for single-seat fighter aircraft. Potential modifications to single-seat fighter CRM should consider the sensitivities and attitudes of the pilots to enhance CRM acceptance and incorporation into everyday flight operations.

Suggestions to Improve CRM Training

The three highest frequencies of F-16 pilots' suggestions to improve CM training were to: assure the concept of training (format, duration, frequency, etc.) enhances the learning process, assure course delivery is applicable to the audience, and consider using another term other than "CRM" for single-seat fighters. The next three highest responses were to: make sure CRM training was tactically relevant, make CRM training applicable to single-seat fighters, and use simulators to reinforce CRM training (see Table 18).

Based on the strength of the pilots' responses, these priorities should form a basis for considering alterations to the CRM training program to facilitate single-seat fighter pilots participation in CRM training process.

Table 17. Axial Coding of Responses

Coding Area	Interview Topics						
	USAF emphasis	Integration top down Guidance	Integration flight operations	Integration simulator operations	IP attitudes	Student attitudes	Total responses
Already doing CRM	11	4	2	-	1	-	18
Being forced to do CRM training	6	7	1	-	-	1	15
CRM not desired term	9	16	19	7	10	5	66
Need to focus on fighters	4	-	1	2	-	-	7
USAF must show it's serious	5	1	-	-	-	-	6
Other positive comments	9	6	13	18	5	2	53
Other negative comments	6	6	8	15	6	-	41

Table 18. Respondent Suggestion Topics to Improve CRM Training.

Suggestion	Responses
Assure concept of training (format, duration, frequency, etc) enhances learning process	30
Assure course delivery applies to audience	22
Consider using another term other than "CRM" for single- seat fighters	20
Make all CRM training tactically relevant	13
General comments	13
Make CRM training applicable to single-seat fighters	9
Use simulators to reinforce training	7
Do not force training to be accomplished	6
Leadership must support training	5
CRM instructors must have credibility	3

Interpretation of Assessment of Learning Styles

The F-16 pilots interviewed self-identified themselves as 48.6% hands-on learners and 17.1% a combination of hands-on and visual learning (see Table 19). CRM courses should be designed to present material in more than one learning style to enhance learning.

Table 19. F-16 Pilot Learning Styles.

Learning Style	Respondents (n = 36)	Percentage
Hands-on Learner	17	48.6
Visual Learner	9	25.7
Hands-on/Visual Learner	6	17.1
Visual/Auditory Learner	3	8.6
Auditory Learner	0	0
Hands-on/Auditory Learner	0	0
No Assessment Made	1	2.7

Because research also indicates that aviators tend to be predominantly hands-on learners, *immediate hands-on application,* such as using distributed mission training (DMT), simulators, interactive computer-based training or interactive training devices, is very important. Research in advanced learned models for aviation education also reveals that in addition to incorporation of all learning styles for knowledge transfer, including the use of immediate hands-on application to improve long-term retention and application, the adoption of adult, cooperative, and observational learning principles and techniques should have reinforcing value in developing CRM training programs (Karp, 1998).

Over the last few decades, the learning model that has been generally used in all aviation education has remained predominantly unchanged. Whether it involves the flight members, crew members in the front of the aircraft, or the mission crews in the back, aviation education has historically involved a highly structured presentation of information in a lecture format, possibly followed sometime in the future by practice in a simulator or the aircraft. While this "lecture now, application in the future" model of knowledge transfer may work relatively well with younger learners, research has shown that aviators, as well as other learners involved in highly technical courses of study, respond more efficiently to an adult learning model (Karp, 1996). When adult learning is combined with cooperative learning, learning style theory, and immediate application, the resulting *integrated CRM learning model* can become a powerful tool to transfer CRM knowledge for long-term retention and enhanced application (see Figure 1).

Integrated CRM Learning Model

Research confirms that mature adults learn differently than younger learners. In fact, adults learn best when they believe that they have a *need to learn* and are *ready to learn.* Normally, adults are self-directed learners and require an instructor to paint a clear picture of *where* a course is going, and *why,* before they are willing to commit themselves to a learning enterprise. Adult learners are unwilling to wait until some time in the future to use their knowledge; they *want to apply knowledge immediately.* Furthermore, research has shown that while adults are least likely to learn in a "lecture-only" environment, they *learn exceptionally well in guided discussions,* after they have been exposed to the baseline knowledge. Additionally, adult learners, such as aircrews who use highly sophisticated technology, respond very positively to multimedia presentations when they are integral to those facilitated discussions. The use of visually and auditorially engaging computer-based training, which could include DMT, simulators, and other interactive training devices, can enable aircrews to immerse themselves in the application of

INPUT: Aircrews with varying levels of experience

Motivation: Stress the *need* and the *time* to learn

Facilitation: Problem-centered Discussions

Scenarios: Aircraft/Mission Specific

Adult Learning

Case Studies: Aircraft/Mission Specific

Group Learning: Interactive & Observational

Immediate Application: DMT, Simulators, & Training Devices

Computer-Based Training

Address all Learning Styles: Visual, Auditory, & Hands-on

OUTPUT: Aircrews with Reinforced, long-term CRM retention /application
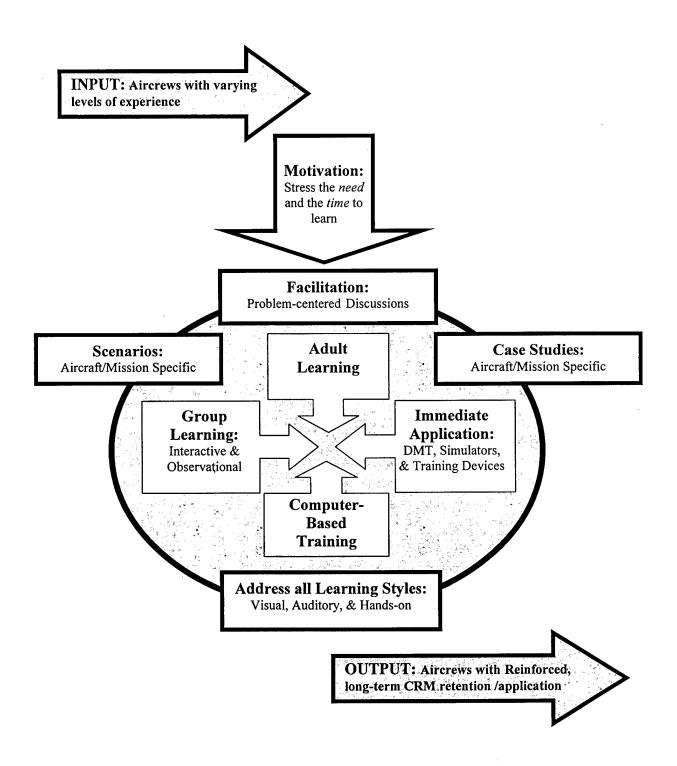
Figure 1. Integrated Cockpit/Crew Resource Management Learning Model

CRM skills during the multimedia learning process. Also, videotape capture of key events in DMT, simulator, and training device missions during unfolding, complex CRM scenarios, coupled with facilitated discussions, can be highly valuable reinforcement training vehicles. Adults also *learn very well from each other*. Again, research indicates that by being involved in discussions within a peer group, adults are very successful in attaining knowledge and retaining it. Additionally, adults benefit from observing others, especially peers who have attained the group's respect, like flight instructors or evaluators. Adult learning is also enhanced by working in groups, especially if they are involved in *problem-centered discussions*. Working a problem with multiple facets is a more effective tool for reinforcing a long-term application rather than memorizing a series of definitions and facts (Karp, 1998).

Additional CRM Research Topics

While reviewing participant responses to open-ended interview questions, several high response trends were identified. It is important to note that these trends were not specifically asked questions, but they occurred spontaneously during interviews relating to CRM core behaviors and skills (see Tables 20 and 21 and Appendices F and G).

The open coding of research data detailed in Appendix G offers a rich narrative for examining F-16 pilots' specific attitudes toward CRM behaviors and skills. When axial coded, this data can provide a picture of the interrelationships between the topical subject areas. An expansion of this research could be accomplished by using expanded observational research a broad segment of both single-seat fighters and multicrew fighters.

Summary of Interview Response Interpretations

The F-16 pilots interviewed displayed a high enthusiasm for their mission and an in-depth knowledge of fighter operations. However, many pilots did <u>not</u> indicate a full understanding of the breath of the Air Force CRM program, or the transfer of the training to enhance combat readiness and effectiveness.

Currently each major command is responsible for developing its own CRM program. Consequently, there have been variances in the content and magnitude of CRM training that pilots have received in UPT, formal training, and continuation training in the operational units. These training programs, which may differ in delivery format and subject matter, could present an environment in which pilots may understand CRM skills and behaviors from different perspectives and to different retention and application levels. Transferring between major commands, and their different CRM training programs, could result in negative learning. Additionally, pilots who have recently gone through UPT and initial weapons systems training have more formal CRM training than pilots who have been in the Air Force longer. This could create a situation where the "older" pilots, including instructors and flight leaders, do not view CRM behaviors and skills with the same perspective as the "younger" pilots.

Table 20. Common Primary Data Responses

Common participant response	Percent of participants
Indicated that fighter pilots already use CRM principles	91
Indicated that CRM is applicable to fighters	94
Indicated that they do not like the term CRM	40
Indicated that CRM is done but is not called CRM in fighters	82

Table 21. Common Core CRM Behavior Data Responses

Common participant response	Valid percent of participants voicing this response
Indicated that CRM principles are important in briefing	97
Indicated that CRM principles are important in debriefing	87
Indicated that a good flight lead is characterized by: -Being a good communicator -Having good people skills -Being knowledgeable -Being a good pilot -Aggressiveness -Being a good overall leader	58 39 33 15 15 6
Indicated that wingmen should speak up: -In flight -When issue may affect mission (including training mission) -During briefing & debriefing -For bad feelings or if uncomfortable with situation	91 47 41 33
Preferred method for wingmen to question or non-concur with lead during flight -Plain English -Knock it off call -Ask questions -Other methods	40 30 23 7

Conclusions
(From interview response data)

1. Potential modifications to single-seat fighter CRM should incorporate the pilots' perceptions, sensitivities, and attitudes to enhance CRM acceptance and incorporation into everyday flight operations.

The term "CRM" conveys a negative connotation to many F-16 pilots because of its origins in multicrew aircraft. Forty percent (40%) of the respondents indicated that they did not like the term "CRM." While 94% of the respondents felt that CRM principles were applicable to them,

33% of the responses on attitudes toward F-16 CRM training related to CRM not being a common or desired point of reference to single-seat fighter pilots. Sixteen percent (16%) of the suggestions to improve CRM training recommended using another term. An interesting side note was that pilots who had previous multicrew fighter experience did not react as negatively toward the term "CRM" as did pilots who only had single-seat fighter experience. In similar perspectives, 91% of the respondents implied that they were already doing CRM and 82% said that CRM was being done, but it was not called "CRM."

2. The structure of the CRM training was important to many F-16 pilots. Forty-one percent (41%) of the suggestions to improve the training focused around assuring that the concept of training (delivery format, duration, frequency, etc.) enhances the learning process and is applicable to an audience of single-seat fighter pilots. Additionally, CRM training does not appear to be integrated into F-16 simulator training. Twenty-three of the interview responses (11.3%) indicated that there was no CRM training conducted in the F-16 simulators.

3. Personal learning styles were easily self-identified by the F-16 pilots. Forty-nine percent (49%) assessed themselves to be "hands-on learners," 26% thought that they were "visual learners," 17% felt that they were a combination of "visual and auditory learners," and no F-16 pilot (0%) thought that they were "auditory learners." While most F-16 pilots (66%) were either a hands-on learner or a combination hands-on/visual learner, they implied that most of their CRM training in AETC was by lecture, using auditor and visual learning formats.

4. CRM training is not consistent within the F-16 community. Eighty percent (80%) of F-16 pilots interviewed had not had CRM specific academics in Undergraduate Pilot Training. This reflects the fact that CRM training has only been introduced over the past few years. For pilots who did not receive CRM training in UPT, CRM initial, instructor, and continuation training are also provided in AETC and in the gaining major commands. While AETC provides CRM training in F-16 Formal Training, it is not necessarily in the same format as that which is provided during CRM continuity training in the gaining major commands.

Research Implications
(From overall interviews)

As with the coding of the data and topic selection for data reduction, the research implications were determined by the principal researcher, a former F-16 pilot and fighter wing commander.

1. Some F-16 pilots did not understand the breadth of the issues that fall under the overall umbrella of the Air Force CRM program and how those components interrelate. However, they do have a good working knowledge of the *individual* components (USAF CRM behaviors highlighted in bold print) in relationship to their mission:

Most F-16 pilots had an excellent understanding of the need for in-depth **mission planning/debrief.** Most pilots used squadron standards for delegating mission planning responsibilities.

Most F-16 pilots had a comprehensive understanding of **flight (crew) coordination/flight integrity** and the roles of flight leader and element leader, but there were variances as to the wingman's role in communication. Most F-16 pilots lean toward the school of thought where the wingman is encouraged to speak up during the mission planning and the flight; however, there were some exceptions.

Most F-16 pilots have a broad understanding of **risk management/decision making**, but there was some variance as to when a flight leader should seek assistance from outside the flight.

Most F-16 pilots had a very good understanding of **task management** and in-flight prioritization.

Most F-16 pilots had an excellent understanding of in-flight **communication** within the four-ship and with other flights and outside agencies.

Most F-16 pilots had a very good understanding of **situational awareness** and how to maintain it or regain it.

2.   F-16 instructor training (in AETC) does not appear to have a broad CRM component that focuses on teaching instructors how to recognize or correct shortfalls in the students' *understanding of, and implementation of, CRM behaviors and skills.* If the instructors are to carry the responsibility of assuring that CRM skills and behaviors are a part of every flight and simulator, then those instructors should have frequent CRM refresher training to highlight recent innovations and developments in CRM and aviation human factors.

3.   Pilots appeared to prefer interactive CRM training with problem-centered facilitation, in contrast to classroom lecture. Some respondents stated a preference for aircraft and mission case studies and problem-solving exercises. Some F-16 pilots expressed a willingness to do more training in simulator missions that integrated CRM concepts, but not as "separate CRM events." However, pilots who had used the ACC/USAFE PC-based situational CRM trainer generally did not think that it was time-effective because it took too long to familiarize pilots with the generic controls.

Recommendations

1.   Consideration should be given to either changing the term "Cockpit/Crew Resource Management" (CRM) to something less offensive to single-seat fighter pilots, or minimizing the use of that term with single-seat fighter pilots and making the same specific CRM training more "transparent."

2.   AETC and the gaining operational major commands should stress that instructors and evaluators must carry the CRM banner in everyday operations. CRM role modeling and constant reinforcement by unit instructors and evaluators are pivotal to the retention of CRM behaviors and skills. Instructors and evaluators should stress CRM behaviors and skills on every flight and in every simulator. This can be accomplished in a "transparent manner" without using the term "CRM;" however, all of the CRM behaviors and skills must still be covered.

3. Instructor and evaluator CRM refresher training should be frequent enough to insure a heightened focus on CRM skills and behaviors and knowledge of the recent developments in CRM facilitation.

4. AETC and the gaining operational major commands should work together to assure that AETC is providing aircraft/mission-specific CRM training that supports the gaining commands' requirements and that the gaining major commands are conducting CRM training that is building on the format and structure delivered in UPT and aircraft/mission-specific formal training. Consistency of behavior, skills, and terminology is the foundation of long-term reinforcement, retention, and application.

5. CRM continuation training (CT) training for AETC training units, as well as operational units, must underscore CRM behaviors and skills, as outlined in *AFI 11-290, Cockpit/Crew Resource Management Training Program,* to assure that pilots are aware of the depth of the CRM issues and the breadth of CRM interrelationships, not only within their own flying operation, but also organizations external to the flying units, such as air traffic control and maintenance.

6. CRM training should use facilitation of discussion to capitalize on adult learning models and to minimize "lecturing," while using interactive computer-based training (CBT) to stimulate class dialogue. Nonattribution discussion and modeling by respected peers within the class are highly effective reinforcement tools. An experienced facilitator, with mission/aircraft credibility and experience, should be required to perform this important task.

7. Formal and continuation academic training should incorporate interactive, hands-on, visual, and auditory delivery methods to include aircraft- and mission-specific case studies, CBT, and video reenactments of good and bad examples of CRM.

8. Formal and refresher/continuation CRM training should be structured to incorporate immediate hands-on application immediately after CRM academic training. Distributed Mission Training would be the most reinforcing, if facilitated in the debriefing by a qualified CRM instructor. If DMT is not available, MDS simulators should be used on training missions, with scenarios designed to create CRM "events" which must be addressed (either by the pilot acting as lead, wingman, or part of a crew). These scenarios would require the simulator instructor to perform multiple, scripted roles of individuals outside the cockpit, such as flight leader, wingman, air traffic control, etc.

9. If Distributed Mission Training or simulator missions with CRM scenarios are not available, consideration should be given to developing an MDS-specific, PC-based flight training device, with embedded self-generating CRM scenarios, for use as a CRM procedural trainer with a facilitated debriefing.

10. Adopt an Integrated CRM Learning Model, using adult learning principles, cooperative group learning, and learning style theory, including immediate hands-on application, to enhance reinforced, long-term retention and application of CRM principles, behaviors, and skills (see Figure 1).

11. Conduct further research to determine the validity of single-seat fighter pilot statements regarding CRM. While this study focused on personal attitudes, the next step would be to conduct research using direct observation of pilot CRM behavior during briefing, flight operations, and debriefing. This observation research will help identify three significant factors: (a) how well single-seat fighter pilot statements about their attitudes toward CRM represent the actual use of CRM in everyday operations, (b) key CRM behaviors of highly effective single-seat fighter pilots, and (c) which specific CRM skills and behaviors should receive the most emphasis during instructor and continuation training because of the uniqueness of each aircraft community. This type of research has been successfully performed with multicrew aircraft (Silverman, Spiker, Tourville, & Nullmeyer, 1997), but has not yet been attempted with fighters.

12. Develop a quantitative survey from the responses of the F-16 pilots' interviews. Administer this survey to selected F-16 units (active duty and Air Force Reserve and Air National Guard). Using a validated F-16 CRM survey, develop a generalized fighter survey to be administered to other representative fighter units in the Combat Air Force to assess the depth and breadth of application and knowledge of CRM behaviors and skills and then develop subsequent modifications of the CRM training to assure the desired knowledge and application level.

Summary

This research was initiated to examine F-16 pilots' attitudes toward CRM and to solicit the pilots' recommendations to improve CRM training. The researchers' intend to broaden the application of this study to all single-seat fighters through further quantitative research. However, in addition to the statistical presentations and interpretations in this report, the F-16 pilots' expanded comments in the appendices already offer a rich source of narrative and quotations that should be helpful in understanding the underlying foundational attitudes of single-seat fighter pilots toward CRM, as well as provide insight into potential enhancements for CRM training for the entire fighter pilot community.

REFERENCES

Air Force Instruction 11-290. (July, 1998). <u>Cockpit/crew resource management training program</u>. Washington, DC: Headquarters, United States Air Force.

Air Force Instruction 36-2243. (June, 1994). <u>Cockpit/crew resource management program</u>. Washington, DC: Headquarters, United States Air Force.

Creswell, J. (1994). <u>Research design: Qualitative and quantitative approaches</u>. Thousand Oaks, CA: Sage Publications.

Filipczak, B. (1995, March). Different strokes: Learning in the classroom. <u>Training, 32</u>, 43-48.

Helmreich, R.L., Merritt, A. C., & Wilhelm, J.A. (1999). The evolution of crew resource management training. <u>The International Journal of Aviation Psychology, 9</u>, (1), 19-32.

Ilgen, D. (1999, February). Teams embedded in organizations. <u>American Psychologist, 54</u>, (2), 129-139.

Karp, M. (1996). <u>Theoretical aviation training for future airline pilots</u>. Doctoral Dissertation, Walden University, Minneapolis, MN. UMI 9713644.

Karp, M.R. (1997, April). A Brief History of Recent Crew Coordination and the Introduction of CRM, <u>Crew Resource Management Newsletter,1</u>, 1, 1-2. Hampton, VA: Mei Technology Corporation.

Karp, M.R. (1998). Aviation education for future pilots: An integrated model. In <u>Proceedings of Interservice/Industry Simulation, Education, and Training Conference, 1998</u>. Orlando, FL.

Merriam, S. (1988). <u>Case study research in education: A qualitative approach</u>. San Francisco: Jossey-Bass Publications.

Potts, D. (1990, September 3). Bias lurks in all phases of qualitative research. <u>Marketing News, 24</u>, 12-13.

Silverman, D., Spiker, A., Tourville, S., & Nullmeyer, R. (1997). Team coordination and performance during combat mission training. In <u>Proceedings of Interservice/Industry Simulation, Education, and Training Conference, 1997.</u> Orlando, FL.

Spiker, A, Tourville, S., Silverman, D, Nullmeyer, R. (1996). <u>Team performance during combat mission training: A conceptual model and measurement framework</u> (AL/HR-TR-1996-0092). Mesa, AZ: Armstrong Laboratory, Aircrew Training Research Division.

APPENDIX A

Respondent Experience (By interview reference number)

Breakout by Rank (n = 36): Lt.:   n = 6   16.7%
Capt.   n = 13   36.1%
Maj.:   n = 13   36.1%
Lt. Col n = 4   11.1%

Breakout by Interview Reference Number

Number:	**1**	Rank: Captain	Position: Flight Commander
Flying Exp:	Total Time:	2700 hours	
	F-16:	1300 hours total/400 instructor	
	Other:	F-4/T-38	

Number:	**2**	Rank: Captain	Position: Academic Instructor
Flying Exp:	Total Time:	1750 hours	
	F-16:	1500 hours	
	Other:		

Number:	**3**	Rank: Captain	Position: Squadron IP
Flying Exp:	Total Time:	2000 hours	
	F-16:	550 hours	
	Other:	T-37 IP	

Number:	**4**	Rank: Captain	Position: Squadron IP/Stan Eval
Flying Exp:	Total Time:	2000 hours	
	F-16:	800 hours	
	Other:	T-38 IP	

Number:	**5**	Rank: 1st Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	**6**	Rank: Captain	Position: Squadron IP/Scheduler
Flying Exp:	Total Time:	1200 hours	
	F-16:	800 hours	
	Other:		

Number:	**7**	Rank: 1st Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	8	Rank: Major	Position: Squadron Assist Ops Officer
Flying Exp:	Total Time:	2500 hours	
	F-16:	1800 hours	
	Other:	AT-38 IP: 500 hours	

Number:	9	Rank: 2nd Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	10	Rank: 1st Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	11	Rank: Captain	Position: Student
Flying Exp:	Total Time:	2560 hours	
	F-16:	65 hours	
	Other:	C-130: 2400 hours	

Number:	12	Rank: Major	Position: Squadron IP
Flying Exp:	Total Time:	2500 hours	
	F-16:	420 hours	
	Other:	F-4D/E/G: 1500 hours; T-38 IP	

Number:	13	Rank: Major	Position: Squadron Asst Ops Officer
Flying Exp:	Total Time:	3000 hours	
	F-16:	1500 hours	
	Other:	A-10: 600 hours; AT-38 IP: 700 hours	

Number:	14	Rank: Major	Position: Flight Commander
Flying Exp:	Total Time:	2400 hours	
	F-16:	800 hours	
	Other:	A-10: 1000 hours; AT-38: 300 hours	

Number:	15	Rank: Major	Position: Squadron IP/Safety
Flying Exp:	Total Time:	3300 hours	
	F-16:	1300 hours	
	Other:	T-33: 1400 hours; AT-38: 300 hours	

Number:	16	Rank: 1st Lt	Position: ANG Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	17	Rank: Captain	Position: Student
Flying Exp:	Total Time:	1100 hours	
	F-16:	75 hours	
	Other:	B-1: 650 hours	

Number:	18	Rank: Major	Position: Student
Flying Exp:	Total Time:	2000 hours	
	F-16:	5 hours	
	Other:	F-15: 1200 hours; B-52 Nav: 1200 hours	

Number:	19	Rank: Major	Position: TX course to be Assist Ops Officer at Spangdahlem
Flying Exp:	Total Time:	2800 hours	
	F-16:	1000 hours	
	Other:	A-10: 1000 hours; AT-38 IP: 500 hours	

Number:	20	Rank: Lt Col	Position: TX course to be squadron leader
Flying Exp:	Total Time:	3500 hours	
	F-16:	1300 hours	
	Other:	F-15: 1000 hours; MIG 29: 300 hours; F-5: 500 hours	

Number:	21	Rank: Captain	Position: Student going to Thunderbirds
Flying Exp:	Total Time:	2300 hours	
	F-16:	10 hours	
	Other:	A-10: 1400 hours; F-15E WSO: 650 hours	

Number:	22	Rank: Major	Position: Chief of Training (Belgium Air Force Exchange)
Flying Exp:	Total Time:	2500 hours	
	F-16:	2000 hours	
	Other:		

Number:	23	Rank: Lt Col	Position: Chief of Wing Programming
Flying Exp:	Total Time:	2500 hours	
	F-16:	970 hours	
	Other:	F-15: 1200 hours; F-4 WSO: 500 hours	

Number:	24	Rank:	Major	Position: Sqdn IP/Chief Stan Eval
Flying Exp:	Total Time:	2300 hours		
	F-16:	1950 hours		
	Other:			

Number: **25**   Rank: Captain   Position: Academic Instructor
Flying Exp: Total Time: 1400 hours
               F-16:   1100 hours
               Other:

Number: **26**   Rank: Captain   Position: Flight Commander
Flying Exp: Total Time: 1800 hours
               F-16:   1500 hours
               Other:

Number: **27**   Rank: Major   Position: Flight Commander
Flying Exp: Total Time: 1300 hours
               F-16:   1000 hours
               Other: F-4D/E/G EWO: 500 hours

Number: **28**   Rank: Lt Col   Position: Ops Off for Range Group
Flying Exp: Total Time:
               F-16:   350 hours
               Other: F-111/A-7/Tornado

Number: **29**   Rank: Major   Position: Asst Ops Off for Range Gp
Flying Exp: Total Time:
               F-16:   1600 hours
               Other: OV-10: 300 hours, T-37 IP

Number: **30**   Rank: 2nd Lt   Position: Student
Flying Exp: Total Time: 300 hours
               F-16:   31 hours
               Other:

Number: **31**   Rank: Captain   Position: Squadron IP/Scheduler
Flying Exp: Total Time: 1000 hours
               F-16:   700 hours
               Other:

Number: **32**   Rank: Major   Position: Squadron Chief of Stan Eval
Flying Exp: Total Time:
               F-16:
               Other: A-10: 1000 hours; UH-60: 900 hours (special ops)

Number: **33**   Rank: Lt Col   Position: ORI Prep; Projected Ops Off
Flying Exp: Total Time: 2500 hours
               F-16:   600 hours
               Other: F-4G: 1600 hours

Number:	**34**	Rank: Major	Position: Squadron Assist Ops Officer
Flying Exp:	Total Time:	2500 hours	
	F-16:	700 hours	
	Other:	F-4: 730 hours; F-117: 275 hours; AT-38: 275 hours	

Number:	**35**	Rank: Captain	Position: Student
Flying Exp:	Total Time:	2000 hours	
	F-16:	900 hours	
	Other:	T-38 IP; Test Pilot School	

Number:	**36**	Rank: Captain	Position: IP/Sqd Stan Eval
Flying Exp:	Total Time:	2400 hours	
	F-16:	1350 hours	
	Other:	OV-10: 800 hours	

APPENDIX B

Respondent Experience
(By pilot category)

Breakout by pilot category

Instructors: 14   39%
Students: 11   30.5%
Leaders: 11   30.5%

Instructors: 14

Number:	1	Rank: Captain	Position: Flight Commander
Flying Exp:	Total Time:	2700 hours	
	F-16:	1300 hours total/400 instructor	
	Other:	F-4/T-38	

Number:	2	Rank: Captain	Position: Academic Instructor
Flying Exp:	Total Time:	1750 hours	
	F-16:	1500 hours	
	Other:		

Number:	3	Rank: Captain	Position: Squadron IP
Flying Exp:	Total Time:	2000 hours	
	F-16:	550 hours	
	Other:	T-37 IP	

Number:	4	Rank: Captain	Position: Squadron IP/Stan Eval
Flying Exp:	Total Time:	2000 hours	
	F-16:	800 hours	
	Other:	T-38 IP	

Number:	6	Rank: Captain	Position: Squadron IP/Scheduler
Flying Exp:	Total Time:	1200 hours	
	F-16:	800 hours	

Number:	12	Rank: Major	Position: Squadron IP
Flying Exp:	Total Time:	2500 hours	
	F-16:	420 hours	
	Other:	F-4D/E/G: 1500 hours; T-38 IP	

Number:	14	Rank: Major	Position: Flight Commander
Flying Exp:	Total Time:	2400 hours	
	F-16:	800 hours	
	Other:	A-10: 1000 hours; AT-38: 300 hours	

Number:	15	Rank: Major	Position: Squadron IP/Safety
Flying Exp:	Total Time:	3300 hours	
	F-16:	1300 hours	
	Other:	T-33: 1400 hours; AT-38: 300 hours	

Number:	24	Rank: Major	Position: Squadron IP/Chief Stan Eval
Flying Exp:	Total Time:	2300 hours	
	F-16:	1950 hours	
	Other:		

Number:	25	Rank: Captain	Position: Academic Instructor
Flying Exp:	Total Time:	1400 hours	
	F-16:	1100 hours	Other:

Number:	26	Rank: Captain	Position: Flight Commander
Flying Exp:	Total Time:	1800 hours	
	F-16:	1500 hours	
	Other:		

Number:	27	Rank: Major	Position: Flight Commander
Flying Exp:	Total Time:	1300 hours	
	F-16:	1000 hours	
	Other:	F-4D/E/G EWO: 500 hours	

Number:	31	Rank: Captain	Position: Squadron IP/Scheduler
Flying Exp:	Total Time:	1000 hours	
	F-16:	700 hours	
	Other:		

Number:	36	Rank: Captain	Position: IP/Sqd Stan Eval
Flying Exp:	Total Time:	2400 hours	
	F-16:	1350 hours	
	Other:	OV-10: 800 hours	

Students: 11

Number:	5	Rank: 1st Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	7	Rank: 1st Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	**9**	Rank: 2nd Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	**10**	Rank: 1st Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	**16**	Rank: 1st Lt	Position: ANG Student
Flying Exp:	Total Time:	300 hours	
	F-16:	60 hours	
	Other:		

Number:	**17**	Rank: Captain	Position: Student
Flying Exp:	Total Time:	1100 hours	
	F-16:	75 hours	
	Other:	B-1: 650 hours	

Number:	**18**	Rank: Major	Position: Student
Flying Exp:	Total Time:	2000 hours	
	F-16:	5 hours	
	Other:	F-15: 1200 hours; B-52 Nav: 1200 hours	

Number:	**21**	Rank: Captain	Position: Student going to Thunderbirds
Flying Exp:	Total Time:	2300 hours	
	F-16:	10 hours	
	Other:	A-10: 1400 hours; F-15E WSO: 650 hours	

Number:	**30**	Rank: 2nd Lt	Position: Student
Flying Exp:	Total Time:	300 hours	
	F-16:	31 hours	
	Other:		

Number:	**31**	Rank: Captain	Position: Student
Flying Exp:	Total Time:	2560 hours	
	F-16:	65 hours	
	Other:	C-130: 2400 hours	

Number:	**35**	Rank: Captain	Position: Student
Flying Exp:	Total Time:	2000 hours	
	F-16:	900 hours	
	Other:	T-38 IP; Test Pilot School	

Leaders (ADO and above): 11

Number: **8**   Rank: Major   Position: Squadron Assist Ops Officer
Flying Exp: Total Time: 2500 hours
            F-16: 1800 hours
            Other: AT-38 IP: 500 hours

Number: **13**   Rank: Major   Position: Squadron Assist Ops Officer
Flying Exp: Total Time: 3000 hours
            F-16: 1500 hours
            Other: A-10: 600 hours; AT-38 IP: 700 hours

Number: **19**   Rank: Major   Position: TX course to be Assist Ops
Flying Exp: Total Time: 2800 hours   Officer at Spangdahlem
            F-16: 1000 hours
             Other: A-10: 1000 hours; AT-38 IP: 500 hours

Number: **20**   Rank: Lt Col   Position: TX course to be sqdn leader
Flying Exp: Total Time: 3500 hours
            F-16: 1300 hours
            Other: F-15: 1000 hours; MIG 29: 300 hours; F-5: 500 hours

Number: **22**   Rank: Major   Position: Chief of Training (Belgium
Flying Exp: Total Time: 2500 hours   Air Force Exchange)
            F-16: 2000 hours
             Other:

Number: **23**   Rank: Lt Col   Position: Chief of Wing Programming
Flying Exp: Total Time: 2500 hours
            F-16: 970 hours
            Other: F-15: 1200 hours; F-4 WSO: 500 hours

Number: **28**   Rank: Lt Col   Position: Ops Off for Range Group
Flying Exp: Total Time:
            F-16: 350 hours
            Other: F-111/A-7/Tornado

Number: **29**   Rank: Major   Position: Asst Ops Off for Range Gp
Flying Exp: Total Time:
            F-16: 1600 hours
            Other: OV-10: 300 hours; T-37 IP

Number: **32**   Rank: Major   Position: Squadron Chief of Stan Eval
Flying Exp: Total Time:
            F-16:
            Other: A-10: 1000 hours; UH-60: 900 hours (special ops)

Number:	**33**	Rank: Lt Col	Position: ORI Prep; Projected Ops Off
Flying Exp:	Total Time:	2500 hours	
	F-16:	600 hours	
	Other:	F-4G: 1600 hours	

Number:	**34**	Rank: Major	Position: Squadron Assist Ops Officer
Flying Exp:	Total Time:	2500 hours	
	F-16:	700 hours	
	Other:	F-4: 730 hours; F-117: 275 hours; AT-38: 275 hours	

APPENDIX C

Respondent Distribution by Flying Experience

Line IP (n = 14)

    F-16 only: (2) (6) (24) (25) (26) (31)
    F-16 + 1-seat exp: (14) (15) (36)
    F-16 + 2-seat exp: (12)
    F-16 + multi-crew: (1)
    F-16 + Nav exp: (27)
    F-16 + UPT IP: (3) (4)

Student (n = 11)

    F-16 only: (5) (7) (9) (10) (16) (30)
    F-16 + 1-seat exp:
    F-16 + 2-seat exp:
    F-16 + multi-crew: (11) (17) (35)
    F-16 + Nav exp: (18) (21)
    F-16 + UPT IP:

Leaders (n = 11)

    F-16 only: (22)
    F-16 + 1-seat exp: (13) (19) (20) (23) (29) (32)
    F-16 + 2-seat: (28) (33) (34)
    F-16 + multi-crew:
    F-16 + Nav exp:
    F-16 + UPT IP: (8)
    Non-pilot:

APPENDIX D

CONSENT FORM FOR INTERVIEW

F-16 COCKPIT/CREW RESOURCE MANAGEMENT (CRM) RESEARCH

Research Study:

You are invited to be in a research study concerning how single-cockpit F-16 pilots apply Cockpit/Crew Research Management (CRM) in daily flight operations. We ask you to read this form and ask any question which you may have before agreeing to be in the study.

This study is sponsored by the Warfighter Training Research Division of the Air Force Research Laboratory. The research is being conducted by Dr. Ron Karp, aviation faculty at Arizona State University and former F-16 Vice Commander and F-4G Wing Commander (office: 602-727-1873), and Dr. Robert Nullmeyer, research psychologist at the Air Force Research Laboratory (office: 602-988-6561).

The purpose of this study is to determine F-16 pilots' attitudes toward CRM, as well as the associated skills needed for application of CRM knowledge. The results of this study will be focused on impacting future CRM training so that training can be tailored to meet the aircrews' specific needs.

The interview concerning your experiences and understanding of CRM should be less than an hour. There are no known or foreseen risks for participation in this study. There will be no monetary compensation for this study.

Confidentiality:

Your name will <u>not</u> be tied to the responses of the interviews; your name will be kept on a separate list only to prevent duplication of interview scheduling. The records of this study will be kept private and in a locked file, with only the researchers having access to the records. In any report we might publish, we will <u>not</u> include any information that will make it possible to identify the individuals interviewed. You will be given a copy of this form to keep for your records.

Statement of Consent:

I have read the above information and asked any appropriate questions. I consent to participate in the study.

Signature _____ _____Date_____

Signature of
Researcher_____Date_____

APPENDIX E

INTERVIEW WORKSHEET

F-16 COCKPIT RESOURCE MANAGEMENT (CRM) RESEARCH

Proposed Research Questions:

1.   **Experience/position/rank/instructor or student status**

"Tell me about your background and experience."

Rank_____

Current Position_____

Flying Experience_____

Background (other aircraft)_____

_____

2.   **Learning Style (visual, auditory, or hands-on)**

"How do you think you learn best? Do you need to "see" the words or diagrams, or do you need to "hear" the words, or do you need to "touch" something to learn the best?"

3. **Overall "attitude" toward CRM training**

"What type of formal training in CRM have you already had?"

"What do you think of the efforts being made in aviation to enhance effectiveness and improve safety by emphasizing CRM training?"

4. **Leadership Emphasis**

"Do you feel that the "top-down" guidance on the integration of CRM into everyday operations is clear?"

Flight and Simulator Integration

"How are CRM considerations are being briefed, employed, and debriefed during flight training missions?"

"What about during simulator training missions?"

5. **Attitudes on Mission Planning/Debrief**

"How are CRM issues covered in flight planning and debriefing?"

6. **Attitudes on *Flight* Coordination/Flight Integrity**

"What role do you think a flight leader should take in a four-ship mission?

"What about the element leader?"

"What role should a wingman take in a four-ship mission?"

"At what point, and *how*, does a wingman question or non-concur with a flight leader's action or decision?"

7. **Attitudes on Risk Management/Decision Making**

"How are risks assessed and decisions made in a four-ship formation different than those made single-ship?"

"At what point does a flight leader or ask for "outside" recommendations/comments?"

8. **Attitudes on Task Management**

"How does a flight leader distribute tasks and workload within a four-ship?"

"How does an individual pilot handle task and workload management?"

9. **Attitudes on Communication**

"What type of factors have you observed that can cause a breakdown in inter-flight communications?"

"What about communication breakdowns with other flights or controlling agencies?"

10. **Attitudes on Situational Awareness**

"Combat and training missions alike are very complex. From your perspective, what can a flight leader do to improve situational awareness in a four-ship?"

"What about in a multi-force package?" (*for non-students*)

"What about as an individual pilot?"

11. Attitudes on Characteristics of Effective Flight Leaders and Wingman

"What characteristics do you look for in a highly effective flight leader?"

"What about a highly effective wingman?"

12. Attitudes on Instructors and Evaluators

For Students: "Do instructors and evaluators use CRM principles with conviction and enthusiasm on every flight and simulator?"

For Instructors: "Do your students understand the importance of CRM principles being used in every segment of flight operations?"

13. Attitudes on Tactical Relevance of CRM Training

"How do you think CRM training can best improve your personal combat effectiveness?"

"Do you have any suggestions on how to improve the CRM training?"

15. Researchers Remarks:

APPPENDIX F

PRIMARY DATA COLLECTION
(Interviews with F-16 Instructor Pilots, Leaders, and Students)

Open Coding of Data

As the qualitative data were collected, recurring themes and descriptive words were used to code similar topics together to form data coding. Coded data were later represented in various matrix forms to aid in cross-referencing the data. Using grounded theory, the data analysis included open coding, which involved determining what themes and categories emerged from direct responses from the F-16 IPs, unit leaders, and F-16 students (Creswell, 1994). The key phrases were collected and coded into meaningful categories. All key phrases were considered for use in the narrative.

Axial Coding of Data

After completion of the qualitative data collection using opened coding of similar topics, axial coding of the data was accomplished by looking at the comparisons and interrelationships of the F-16 pilots in regard to CRM. During the course of the study, the topical coding of the responses evolved and was recoded as necessary to depict an accurate portrayal of F-16 pilot CRM. Axial coding tabulations are reflected in the findings component of this report

Narrative Format

The following narrative description of the respondents' remarks is arranged in axial coding within each original open coding topic. The parenthesis following each response refers to the demographical identification of the respondent in Appendix A.

<u>CRM Formal Training</u>

<u>Undergraduate Pilot Training (UPT)</u>

- At UPT at Sheppard AFB in 1993, received CRM component in prioritization and task management, but they did not know how to deal with single-seat CRM concept (8 to 12 hours). (27)
- Navy classes involving mostly slide shows. One hour of instruction before flying T-34s, and then one hour at the end of flying. The Navy also used some "role-playing" which was good. In T-38 training, 1-hour class focused on multicrew CRM with some of the same slides the Navy had shown. (5)
- Only 1 hour in T-37 academics. Also a short session in AT-38s. Both of these were mostly pictures of aircraft crashing. (7)
- Total of three hours of classes: At beginning of UPT as overview, halfway through T-37s, and at end of T-38s. Taught by physiology training people. Mostly general information, but were shown three films showing crashes with good and bad examples of CRM (9)
- Five hours in UPT on general subjects by aviation physiologists. (10)

- Once in a pilot meeting in UPT. (18)
- In T-37s/T-38s, about 2 to 3 hours of lecture on risk assessment, CRM, and communication, using mostly videos of good and bad CRM and mishaps. (30)
- One to two hours in Introduction to Fighter Fundamentals (IFF). (30)
- Had crew coordination, but it was not called CRM. (36)

F-16 Formal Training (FT)

- "Classroom" at Luke, 4-hr course, in generalized physiological training and situational awareness. (1)
- In FT, CRM training was tailored to practical applications, but instructor is not a "true believer." One-hour mass briefing to "fill the square." (2)
- It was in the middle of all other academics. (3)
- No real CRM in FT. Simulator IPs don't give any help during EP simulators. (12)
- Received a briefing by safety people that was supposed to be on how CRM applied to fighters, but it really showed how "CRM is for multicrew airplanes." (14)
- Short lecture at Moody in squadron. (26)
- Twice in training at Luke (1993), mostly about tasking in cockpit. However, some people are beginning to recognize that this is more than just where you put the checklists in the cockpit. (27)
- Course in "Human Resource Management" which had some CRM and lots of aviation physiology like "G-LOC." (5)
- One hour in formal training at Luke. (7)
- Two hours at Luke on general subjects. (10)
- Some risk assessment at Luke, but no videos. Instructor is an aviation physiologist and it would be better if the instructor was a pilot. (30)
- In TX transition course (1991) had one hour in air-to-air and one hour in air-to-ground from the training squadron on accidents and error chain. (35)
- Responsibilities, emergencies, etc, in 1992. (36)
- Principles in bits and pieces during training, but "not as CRM specific." (8)
- Some general awareness a few years ago called "AAAMP" which covered G-LOC and situational awareness. (19)
- F-16 TX pilots are given a shortened version of what the B course pilots get, but even that is not specifically called CRM. (19)
- Had something at Hill in mid-90s, but didn't remember what it was. It had a lecture and not the ACC CRM van. (29)
- At Mountain Home (1992) initial training was by physiology instructor. Only 10% useful and couldn't remember what was taught. (32)
- None: (23) (9) (11)

F-16 Instructor Course (I)

- "Luke training paled in comparison to the dedicated ACC CRM van program."(3)
- In academics at Luke we talked a little about CRM, but it was mostly a "square-filler." (6)
- Discussions included how CRM relates to Luke. (24)

- Classroom lecture by wing aviation physiologist went over case studies for about 2 hours. (25)
- We only had a "contingency meeting" with squadron commander to discuss emergency procedures and how to resolve problems. (26)
- 1 to 1 ½ hours at Luke on common errors students will make. (22)
- Lecture by physiologist on stress and what to look for in students. (33)
- None: (23) (29) (27)

F-16 Continuation Training (CT)

Note: Comments are ordered by MAJCOM and whether the comments were neutral, strongly positive, or less than positive experience.

AETC.

Neutral (or mixed) experience (n = 12):

- "Classroom" at Luke, 1-2 hr course in generalized physiological training and situational awareness. (1)
- In periodic physiological training, with G-LOC, stress, etc. (1)
- Part of physiology training, but was mostly risk assessment and task management. About 1 to 2 hours. (4)
- CRM training in operations is integrated into daily flying activities, it is not separated as a separate subject. (6)
- Once a year at Luke in a classroom for a couple of hours. (25)
- One hour of discussion using slides and videos on incidents and accidents taught wing aviation physiologist. (26)
- One hour at Luke talking about incidents and accident prevention. (31)
- In ops unit, had about 45 minutes of "misprioritization that leads to mishaps." (20)
- 1 to 1 ½ hours per year in squadron at Luke, given by the Academic Squadron aviation physiologist, covering incidents and accidents and the thought process that occurred. This is a "grounding item" if it is not attended. (22)
- Case studies once a year by wing aviation physiologist. (28)
- Once a year squadron talks about risks. (33)
- Only general terms in pilots' meeting and safety meetings. (34)

Less than positive (n = 1):

- One hour of lecture in classroom: "Everyone hated it." (32)

ACC/USAFE/PACAF (n = 8).

Neutral (or mixed) experience (n = 6):

- USAFE CRM van in 1995 at Aviano (ACC contractor) was useful. It is a good idea, but it focused heavily on when you should speak up. Discussion of incidents was beneficial, but the use of the small flight simulator in van was <u>not</u> cost effective. (24)
- Two days in classroom at Ramstein (1992). Mostly lecture and discussion about accidents. (24)
- At Hill and in Korea. At Hill in ACC CRM van in late 1996. What they offered was good, but it took a whole day and we were already doing what they recommended. (36)
- ACC CRM at Moody was "decent stuff," but was too long (4 to 5 hours). Setting up the situational trainer (PC flight simulator) took too much time. (31)
- At Mountain Home in 1995 in the ACC CRM van. First couple of times it was worthless because it had a heavy focus on multiengine CRM. But then it changed to move to more single-seat focus and fighter application and became a very good refresher. PC flight simulator was fun, but <u>not</u> useful. (33)
- ACC mobile CRM van at Shaw (twice). Worthwhile training, but it was a little long because of the day-to-day operational tempo. It drives things like shooting the gun to the weekends. (4)

Strongly positive experience (n = 6):

- ACC "CRM van" at Mountain Home, 4-hr course. Hands-on training really useful, along with case studies and instructors with fighter background. (1)
- Tactical scenarios in the ACC CRM van at Mountain Home were very relevant. (1)
- ACC van at Mountain Home: First time they were just getting started and it was hit and miss, but the second time (1997) was better. The situational trainer was good to let young guys know how they fit into a 4-ship picture. (14)
- ACC "CRM van" at Hill (twice). It had "very worthwhile with applicable scenarios, but the situation trainer not very useful for continuation training." (3)
- Six-hour course at Spangdahlem in CRM van 1996. Case studies were good, but CRM or emergency training in a real simulator would have been better than the PC-based simulators in the van. (25)
- ACC CRM van at Davis-Monthan (A-10) for 4 hours. Case studies using video and group discussion were excellent. Sterile environment (no interruptions) creates very good atmosphere to learn how different people handle CRM issues. Hands-on tasks, using CBT and computer flight simulator, were very beneficial to emphasize hands-on, quick decision making. Really liked the ACC CRM video playback capability with "comm"and the experienced instructors. (21)

Less than positive experience (n = 6):

- Did not have time to go to CRM training in the USAFE CRM van at Spangdahlem, Germany, but "heard" from friends that it was half good, half bad. The bad part was that it was too "heavy aircraft" orientated. (6)

- *Initial* CT training at Shaw in ACC CRM van for 4 ½ hours, including a 2-hour hands-on trainer. Some of the exercises were very useful to emphasize CRM issues. However, *follow-on* CT was a waste of time for single-seat fighter pilots (except for F-15E and EF-111s) because it emphasized too much "crew coordination." (12)
- Took ACC initial CRM at Shaw in the van but it "was not different from what I was already doing: brief-fly-debrief. Didn't learn anything new." (13)
- "Saw" ACC CRM van, but did not go through the course because it took so much time. (20)
- At Kunson, lecture and slides, but too slide show oriented. (28)
- Four hours at Holloman in ACC CRM van following a mission profile (1996). "Not very productive; I already knew that I was supposed to use all of my resources." (18)
- None: (23) (29)

Other CRM Formal Training

- The best CRM training was going through the accident investigation school at the Safety Center at Kirkland. It was heavy on human factors. (6)
- As a former navigator, received a lot of *crew coordination* in nav school, Holloman WSO lead-in, and F-4 school. (27)
- In first F-4 operational unit in late 80s, received CRM that was applicable only to heavy, multicrew aircraft. (27)
- In operational F-16 unit, had a general lecture once a year along with all the other briefings. (27)
- Twenty hours total at Kirkland, Hurlbert, and Kadena. Mostly just classroom lecture and slides. (11)
- Old "AAMP" program at Seymour Johnson and Shaw was only "lip service to CRM done by flight surgeons." It had more of a focus on flying than interpersonal relationships. (21)
- Some CRM at centrifuge training on task management and psychological training (1.5 hours). (28)
- At AF Safety School at Kirkland (1997). Reviewed case studies of accidents and listened to recordings and read findings. (29)
- Talked about "crew coordination" when in F-4 ops unit. (34)
- Never talked about CRM in F-117. (34)
- In A-10 Instructor course, had a 1.5 hour overview of CRM concepts, but it was not beneficial for IP duties. (21)

Attitudes Toward F-16 CRM Training Program

USAF emphasis on CRM

F-16 pilots feel that they are already doing CRM.

- CRM is already in place for single-seat fighter, in regards to training rules, risk assessment, briefing to lowest common denominator, and weather considerations. (1)
- "It can't hurt, but it is not that beneficial nor will it help save an accident because we do it already." (24)

- "In the single-seat world, CRM has always been done, like prioritization and where to put things. (25)
- "I don't know if it's useful training." (25)
- Fighter pilots have always trained to prioritize tasks and use coordination, but under different names. The use of additional new CRM terminology causes some concern. (4)
- Some of the things in CRM training you can use, but most is just common sense. (31)
- It is already being done. (5)
- Everything is already laid out already for single-seat fighter (through the "contract") so there is no need to training to do CRM. (29)
- CRM is something you do everyday, but cannot define. (32)
- We've been doing CRM all along, but we haven't called it CRM. (36)
- There is a lot of resistance to CRM training because the fighter community has been doing this for years; it is just that they did not call it anything. (33)

F-16 pilots feel that they are being "forced" to do CRM training.

- Just "do" CRM, do not "invoke" it. (1)
- "CRM training is something that you're forced to do to fill a square."(2)
- If leadership says: "Here's CRM, just go do it, it doesn't work! The more in-tuned the leadership is with what's going on on the flight line, the better CRM guidance will be given." (6)
- "I don't like things that are 'imposed' upon pilots. CRM is too forced." (12)
- "CRM is the official way to cover the Air Force's butt." (24)
- Very negative opinion. "It's just another one of those things we have to do; the latest management de jour." (20)

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- CRM is something that is aligned with a crew concept and is not applicable to single-seat fighter pilots, but "CRM concepts" are ok and applicable. (2)
- "Never refer to CRM as 'CRM' because it will turn people off!" (14)
- CRM is not a term that is used or talked about. (7)
- In heavies, CRM covered safety, crews speaking up, getting people to speak up. Not much CRM in fighters. (11)
- At Luke, CRM principles are being given in each flight, but not referring to them as CRM. (21)
- "Anything we can do to lower the mishap rate or help the new kids is important, but it matters what you call it." Do not call it "CRM." (18)
- CRM is for multiplace aircraft, not F-16. (23)
- The name CRM probably needs to be changed because of a lot of pilot's sensitivity to it. (28)
- CRM is applicable to crew aircraft, like F-15E and C-141, but it is not applicable to single-seat fighter. (29)

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- "CRM is not really being addressed toward a single-seat audience." (14)
- Effort is good, but CRM needs to be specialized for single-seat aircraft using flight communication techniques, instead of using multiplace airplanes and flight deck communication procedures. (35) (36)
- Needs to be single-seat specific. (1)
- From a single-seat pilot's view, CRM is not really applicable to the fighter world. (33)

USAF needs to show that it is serious about CRM.

- "Great reluctance of the captain-on-the-street to adopt something unless they see that the Air Force is serious about implementing it." (14)
- Not sure people know what CRM is. Some like it; some think that it is bunk. There is a lack of dollars to support the CRM program, but "we talk a good game." (15)
- The program is evolving and getting better. It is worthwhile, but we do not enjoy doing it. If it is not formalized and required, then people will not do it. (27)

Other *positive* comments.

- "ACC program is a vast improvement over past programs." (3)
- While people have not been responsive to CRM in the past, they seem to be getting better. (10)
- Much more concentrated effort now because it is being taught by experienced aircrews, not flight surgeons. (21)
- Studied CRM for airlines in college, but now sees the benefits to fighters. (30)
- CRM is valuable because it encourages students to speak out. (30)
- "Formal program is a step in the right direction." (19)
- "Anything that will improve safety and not degrade combat capability is good." (36)
- CRM training is useful if it is done the right way and not just filling a square. It should be more frequent and not just annually. (34).
- Since CRM deals with emergency procedures, it should be discussed during the "emergency of the day" in the flight briefing. (26)

Other *negative* comments.

- "It's wasting my time. I am not a big advocate of CRM." (13)
- Every two or three years the Air Force comes up with a new "program to worship." (36)
- After the first question about the efforts being made in the Air Force to enhance effectiveness and improve safety by emphasizing CRM training, the respondent said to interviewers (in a harsh manner): "You tell me, just what does the Air Force intend to do with CRM...." (32)
- If CRM training takes a long time, single-seat fighter pilots will go to it with a negative attitude. "The shorter you can make continuation training, one hour desired, the better." (31)
- "I came out of a staff tour and I'm not really up to speed on CRM." (8)

- There is reluctance for people to speak up because they might sound stupid. If it is a safety of flight issue, then they should speak up. (29)

Integration of CRM into everyday operations (*Top-down guidance* to pilots)

F-16 pilots feel that they are already doing CRM.

- We know about CRM "once in a while by hearing a buzzword, but it's really a different name for something we've already been doing." (25)
- "It's just part of our job and it's something that doesn't require any direction." (32)
- Fighter pilots already do CRM, and it's "common sense." (36)

F-16 pilots feel that they are being "forced" to do CRM.

- "Everyone was told that they "would go to CRM training" and it was just put on the schedule."(3)
- Message is clear that we "have to do this, but the real reason we have to do it is to fly." (14)
- It's something that you just have to do; just "salute and do it." (20)
- It is apparent that it is a command-wide directive that must be taught. (33)
- Guidance is clear that "higher-ups" want it done. (19) (34)

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- Squadron commander is into it, but he does not reference the word "CRM" as a separate issue. (1) (6)
- Never any "direct guidance on CRM," but they talk about CRM issues. (2)
- "Absolutely coming down, but not specifically under the 'CRM' label." (4) (14)
- Only in regards to using common sense and all your resources. But people do not say the word "CRM." (31)
- "Someone at the top thinks it's important. It's not just filling a square, but it's really not for us, it's for crew planes." (5)
- "I never heard the word CRM used once at Luke." Everything comes down to "lead" and "wingmen." (7)
- "Don't ever hear the word "CRM" used, but they do discuss things like "comm drill" and "don't be afraid to tell me if you see something screwed-up." (9)
- CRM principles are encouraged, but there is no formal CRM discussion. (11) (18)
- CRM never mentioned specifically, but some issues are covered in flights and classes. (30)
- In commander's call a lot of "safety issues" are discussed, but not especially as CRM issues. (22)
- The message is given in the multicrew aircraft, but not in the single-seat community. (29)
- Squadron Commander and Operations Officer stresses some CRM subjects, but never mention the word CRM. (14) (24)

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- No applicable responses.

USAF needs to show that it is serious about CRM.

- The Air Force has placed emphasis on CRM, but it is not clear in the wing or squadron as to the specific direction. (35)

Other *positive* comments.

- Mentoring is very important for the IPs to show students the importance of CRM concepts.(1)
- AETC stresses "rules" and the IPs emphasize them. "CRM helps give you 'common sense' when you don't have any." (12)
- There has been a high emphasis in the wing, because of the nature of the business and potential emergencies, to incorporate it into the briefings. (26)
- "Absolutely – it has to be from the top." (21)
- It is clear that "the threat is out there all the time, so you can't let your vigilance down." (21)
- Use all facilities and resources at your disposal. (23)

Other *negative* comments.

- There are so many projects going on all the time, that people only have time to focus on the current hot topics. (27)
- "People think CRM is a good tool, but hard to implement." (10)
- Older guys "turn-off" phrases like ORM and CRM, but components are discussed." (8)
- There's a resistance at the operator level to implement CRM because of its background in multicrew aircraft. (36)
- Hard to do because "all the paper work and flying that needs to be done in a long duty day; but it is OK if it is a good program."(3)
- In ACC it was clear guidance. In PACAF there was <u>no</u> guidance. In AETC, it's not really talked about specifically. (13)

Integration of CRM into everyday operations (Integration into flight operations).

F-16 pilots feel that they are already doing CRM.

- "CRM has always been done in the single-seat world, that's why single-seat guys 'cut-up' on CRM." (21)
- Difficult to implement as a specific effort because some CRM is interwoven into everything we do, like mission planning, support in flight, and debrief. (8)

F-16 pilots feel that they are being "forced" to do CRM.

- Principles should be applied, but no one wants another line in the briefing guide that says: "CRM." (19)

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- CRM is integrated into mission planning and flight operations, but not mentioned as a separate topic. (1) (14)
- IPs don't talk specifically about CRM, but they talk about student's cockpit, where the student fits into the flight, rules and responsibilities of all flight members, prioritization of responsibilities, and task saturation. (2).
- CRM is not talked about directly as CRM, but it is filtering down that single-seat fighter pilots "have to talk to others in the system" (SOF, Top-Three, etc). (3)
- CRM is never discussed as a specific subject, but some CRM considerations are integrated. (4)
- "Heavy guys need CRM because the different people in the crew are all thinking about separate issues and do not see the same big picture. Fighter guys need to get everyone to be able to think independently and always see the big picture." (6)
- "CRM is done better by fighter pilots than anyone else, but we don't think of ourselves as crews." (6)
- Principles and concepts are integrated in everyday life, but not specifically as CRM. (25)
- No one ever talks specifically about CRM. CRM is not done intentionally, it is "just a by-product of what we do naturally." 27)
- It is being implemented and covered, but it's not called CRM because "CRM is for multi-crew airplanes." (5)
- Although CRM principles are discussed, "CRM is never mentioned by name." (7) (18)
- The IPs talk about it, but not specifically. (10)
- It is done on regular basis, but it will not be labeled as CRM. (21)
- Never hear: "we're going to do some CRM today...." (30)
- CRM is part of an everyday briefing, but not as a CRM topic. (35)
- Core principles are probably followed, but hardly ever hear the word "CRM." (23)
- Almost everything is briefed and conducted in accordance with the squadron standards, but they do not focus on CRM issues and they do not ever call it "CRM." (33)
- CRM considerations probably take place, but not under the label of "CRM." (34)

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- "Most CRM training has been focused on crew plans, so it's not always applicable, but the single-seat guys try to translate it." (5)

USAF needs to show that it is serious about CRM.

- No applicable comments

Other *positive* comments

- Components are incorporated in daily ops. (11)
- "Briefing Room 2000" concept, which uses PowerPoint drawings and videos to emphasize key points, allows the flight lead to give a more comprehensive briefing. It also assures that the flight lead will not "draw a wrong picture on board of radar, HUD, etc. (22)
- For two-seat F-16 flights, a coordination briefing is accomplished which covers who's in charge, and stresses situational awareness and decision making. (22)
- As a flight lead you cannot do everything yourself, so you have to delegate responsibilities, like radar search, radio communications, etc. (32)
- CRM helps tell pilots what might go wrong before it do something wrong. (1)
- CRM directly relates "when something goes wrong." (3)
- CRM is really about being a good flight leader/pilot. (3)
- CRM is useful and effective because it can "keep us alive." (4)
- CRM helps you fly better and go to combat better. (11)
- CRM is using everything you have, to do the best you can. (31)
- In CRM you should use the wingman in the briefing and encourage them to speak up during the flight. (31)
- Special interest items help emphasize potential problem areas. (33)

Other *negative* comments

- "CRM training is all about 'stating the obvious'." For example, they tell you: "if you are headed for the ground, pull up. (29)
- You should manage your cockpit yourself; you don't need help. (29)
- CRM issues are sometimes addressed because of the training environment, but there is too much emphasis on the syllabus and not enough flexibility. (14)
- Easier in training unit than operational unit. (18)
- In F-16s there is not a lot of opportunity to plan together because of the tight schedule, but the debriefs are good. (13)
- You can pick up most of what you know in a squadron, regardless of the academics and from the IPs. (7)
- Dedicated CRM courses are vague, but when it's applied is when the different components are put together and it really becomes useful. (10)
- "It is only relevant if it helps meet mission objectives." (13)
- Sometimes CRM issues are discussed in reference to emergencies. (30)

Integration of CRM into everyday operations (Integration into simulator missions)

F-16 pilots feel that they are already doing CRM.

- No applicable comments.

F-16 pilots feel that they are being "forced" to do CRM.

- No applicable comments.

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- Sim IPs do talk about some CRM behaviors and skills, but not specifically, and never with the term CRM. (7)
- CRM is not discussed, except for things like communications with SOF, etc, during emergency procedures. (10) (18)
- Mostly procedural in handling emergencies and carrying out to logical conclusion, but no mention of CRM specifically. (21)
- CRM is not really talked about in the simulator. (35)
- Boeing instructors do cover some CRM in the simulator, but not under the term CRM. (8)
- Boeing IPs are good, but they teach the "priorities of flight," not CRM. (13)

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- Simulator always single-ship, so it is not good for interflight CRM. (1)

- Simulators are focused on "single-seat" training, with no wingmen or leaders, so no real CRM taught. (2)

USAF needs to show that it is serious about CRM.

- No applicable comments.

Other *positive* comments

- Good assessment of adhering to procedures and training rules. (1)
- Good for task prioritization (EPs, etc.) and information overload. (1)
- Good to practice "maintaining aircraft control" during EPs. (1)
- Good to simulate weather. (1)
- If student asks the sim instructor to be the SOF or to read the checklist, most of the sim instructors do respond. (35)
- During simulator checks, the respondent (as Stan/Eval) plays a good wingman and "reads the checklist" and "looks over the aircraft" if asked, and will "give radar vectors" as ATC, if asked. (32)
- Boeing instructors, or other IPs, will read checklist or do SOF duties if you ask them to, but not much discussion of CRM. (34) (33)
- Sometimes the stan eval flight examiner (SEFE) giving an emergency procedures simulator will tell the pilot that he will play the role of the SOF, the wingman, ATC, etc. The SEFE will read the checklist, give vectors, obtain the weather, or whatever is requested by the pilot in the simulator. (36)
- Boeing guys are very professional and knowledgeable in the simulator. (22)

- Some prioritization and task management. (4)
- There is some improvement in what's being taught in the sim; the contract instructors are experienced fighter pilots and do a good job explaining "why" you need to do something. (6)
- The decision making process is discussed. (24)
- The UTDs (desktop simulators for students in academic building) are very good tools. (25)
- Boeing instructors do some emergency procedures in simulator. (26)
- Although Luke IPs do not give the students simulators except the air-to-air TAC ACES, when this pilot "gets" a simulator, he calls the Boeing instructor to "look him over" as the chase pilot and also uses him to act as the SOF to get additional information. (31)
- B Course guys see all new things in the simulator first. (22)
- Must be heavily debriefed. (1)

Other *negative* comments

- CRM is occasionally discouraged in the simulator because some of the simulator IPs don't read checklists as the SOF, as it is taught in CRM training. (30)
- Not much emphasis. (19)
- No new concepts taught; just worked on task prioritization. (20)
- Boeing guys are noncurrent pilots, so that creates a problem. (29)
- Boeing guys do not have time to look at things like CRM because they are working the syllabus requirements. (29)
- Sometimes negative training because contract instructor give procedures which are different than ones currently used. (1)
- Not being given in simulator because simulators are tactically oriented for specific training missions. (3)
- CRM is not integrated into simulator missions, and they should be. (12)
- CRM is not integrated into simulator missions because the pilots are too busy doing "hands-on stuff." (14)
- Use TAC ACES simulator for air-to-air set ups, but no CRM. (26)
- CRM is not done intentionally in the simulator. (27)
- Emphasis is not on CRM, but rather on the specific mission because of the limited time in the simulator. (5)
- Nothing specific, but some of the individual skills (like communications) are taught in passing. (9)
- CRM subjects are covered only in EP debriefs. (11)
- Squadron IPs rarely instruct in the simulator, except for TAC ACES. (8)

Instructors' attitudes of students' understanding of use of CRM

F-16 pilots feel that they are already doing CRM.

- Using CRM in single-seat fighters should already be inherent to the students' training. Everyone already emphasizes to call the SOF if you have any problems. (31)

F-16 pilots feel that they are being "forced" to do CRM.

- No applicable comments.

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- IPs do not ever use the word "CRM", but do emphasize it. (1)
- Word CRM creates "hostile" attitudes. (1)
- There is "no specific talk of CRM, but students are willing to speak up." (3)
- Students understand the subtasks of CRM but do <u>not</u> like the term "Crew Resource Management" because they say that they are "not in a crew airplane" (4)
- They do <u>not</u> understand CRM as specific training; it is just integrated into what they do. (13)
- They do <u>not</u> tie CRM principles and behaviors to the term "CRM." (23) (29)
- Single-seat pilots hate words with "crew" in them. They want to use pilot instead of crew, for example: pilot van vice crew van; pilot rest vice crew rest; and pilot meeting vice crew meeting. (29)
- The question should not be "do they understand use of CRM," but rather "do they know the buzzwords for CRM." (32)
- While younger pilots understand the word "CRM" and mention it occasionally, older pilots mention the topics, but <u>not</u> the word CRM. (34)

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- No applicable comments.

USAF needs to show that it is serious about CRM.

- No applicable comments.

Other *positive* comments

- There has been more emphasis on "roles and responsibilities" lately. (2)
- Positive trend over the last 5 years. (3)
- TX course (short transition) students have no problem with integrating CRM because they are experienced and have seen breakdowns before. (33)
- The RTU business is about "showing them a picture, so the student can put it in their bag of tricks." (1)
- Students don't understand the importance initially, but by the end of the program they are beginning to learn "how to time-share." (27)

Other *negative* comments

- Students do not know what is going on with CRM because they are overloaded. The IPs do the CRM for them, but they do not know it. (1)

- "Students come into F-16 formal training <u>too CRM oriented</u> and are too willing to speak up right away. They forget that they are in a single-seat fighter." (12)
- "Students are struggling with CRM because they are being taught in F-16 training to be self-thinking entities, and in AETC that was discouraged." (14)
- "They understand that it's important not to die while they're flying, but probably not more than that." (24)
- One-third have the big picture about CRM and two-thirds do <u>not</u> have the big picture and get task saturated easily because of the upfront controls and embedded screens. (26)
- B course (long) students do not understand CRM other than what is taught in class because they do not have the experience to know what might break down in flight. (33)

Students' attitudes of instructors' and evaluators' use of CRM

F-16 pilots feel that they are already doing CRM

- No applicable comments.

F-16 pilots feel that they are being "forced" to do CRM.

- IPs have always done CRM, but do <u>not</u> like to be told to do it. (18)

Use of the term "CRM" is not a common or desired point of reference for F-16 pilots.

- Most instructors cover some CRM issues, but they do <u>not</u> call it CRM. Issues are discussed while covering different flying principles. (5) (21) (35)
- Most IPs use parts of CRM, but never refer to it as CRM. (10)
- IPs are enthusiastic about flying, but never mention the word CRM. (11)

F-16 CRM training should focus on single-seat, not multicrew, aircraft.

- No applicable comments.

USAF needs to show that it is serious about CRM.

- No applicable comments.

Other *positive* comments.

- Standard communication really stressed. (7)
- Situational awareness is stressed a lot and is vital prior to entering the aircraft. (7)

Other *negative* comments.

- No applicable comments.

Suggestions by respondents to improve CRM training

Make all CRM training *tactically relevant*

- Use tactical scenarios in training to make it interesting and keep students minds thinking about it. (1)
- Minimize psychological terms. (1)
- Put it into "fighter pilot" speak. (1) (6)
- CRM should be taught in every segment of flight. (25)
- Needs to oriented to the real world. (28)
- Find ways to put CRM topics in plain English and assure that they are applicable for each specific mission. (34)
- War stories are helpful. Bar talk about good and bad things that have happened is good. (1)
- The more the tactical relevance of the CRM principles can be applied, the better the outcome of the mission. (2)
- Anytime you work with fighter pilots you will have challenges. Must stress "practicality" and "relationship to mission objectives." No fluff! (2)
- Must emphasize tactical relevance in everything. (23)

Make CRM training *applicable to single-seat fighters*

- Make it applicable to single-seat fighter pilots. (1) (2) (5) (23) (33)
- Think of CRM from the perspective of a single-seat pilot. (12)
- The effort is good, but CRM needs to be specialized for single-seat aircraft using flight communication techniques, instead of using multiplace airplane flight deck communication procedures. (35) (36)
- Show application of CRM to single-seat jet. (23)

Consider using another term for single-seat fighters other than Cockpit/Crew Resource Management

- "CRM is a dirty word to the fighter community", don't ever refer to CRM, but just teach the subtopics. (4) (6)
- Call CRM something different for fighter guys. (4) (6)
- Do not talk "Crew Coordination", talk "Flight Integrity." (6)
- Do not talk "Aircrew Member", or Aircraft Commander" (6)
- Do not use the words "CRM" or "Crew Resource Management;" they are "dirty words." Use only subtopics. (5) (18)
- Change the name CRM to something that is not labeled as being from the heavy community. (11)
- Make CRM training more transparent to the pilots. Discretely put it into other information without it being highlighted as a separate program. (20)
- De-emphasize multicrew CRM (the genesis of CRM). The reaction of the fighter world to CRM is to "scoff" at it. (23)

- Must "sell" CRM concepts, but *not the word*, to the fighter world because they think that they are already doing it. (23)
- "Don't talk about CRM per se." (29)
- F-16 pilots "shut off" at the use of the term "CRM." It is not for F-16 pilots since they have no crews. (32)
- "F-16 pilots do not use management or resources, and the word 'cockpit' sounds like where you put things in the cockpit, so just drop the name CRM. Maybe call it 'fighter pilot situational awareness." (32)
- Do not use the word CRM, it will shut single-seat pilots off. (34)
- Change the term from "CRM." Do not use buzzwords that send the wrong message. Maybe use the term "Tactical Resource Management. (36)
- Never refer to CRM as "CRM" because it will turn people off. (14)
- It matters what you call the training. "Do not call it CRM." (18)
- The name CRM probably needs to be changed because a lot of single-seat pilots are sensitive to it. (28)

Assure *course delivery is applicable* to audience

- Talk about instances where a mission was messed up by someone not listening in the briefing. (12)
- Show examples of things that have gone wrong before and discuss them. (14)
- Use of case studies of accidents is very good. (24)
- Classes should be taught visually as well as auditorially, and related to the squadron's mission. (24)
- Single-seat pilots like case studies on where things have broken down in the past and what could have been done to prevent incidents/accidents. (26)
- Use "role-playing" by giving different people different information and see how they coordinate it together. (5)
- Do not use old videos of accidents and crashes over and over to motivate. (5) (7)
- Use recent videos of good and bad CRM. (9) (30)
- Have more "hands-on" training. (9)
- Have more "case-studies" of accidents using the specific aircraft flown. (9)
- Have more films and videos and then talk about it. (11)
- Case studies and hands-on experience are excellent. (21)
- Prevent complacency by using examples and case studies. (21)
- Do not use big-room lectures with a lot of "concepts." (21)
- "Sitting in a room and talking about CRM is not good." (13)
- Meld CRM with safety and use accidents and incidents that are applicable. (32)
- Go over accidents and where the flight broke down (the chain of events). (33)
- Stress how actions or inaction caused problems downstream. (33)
- Having a discussion on safety messages is a good format. (13) (19)

Assure *concept of training* (format, duration, frequency, etc) *is enhancing* to learning process

- Do only quick review during continuation training. (1)
- Shoot straight. (2)
- Keep it from being "Mickey Mouse." (2)
- Give it in a time of day when students can absorb material. (3)
- Have a mixture of experience in the class to keep it interesting. (3)
- Stress the *CRM subtopics*, not CRM as the topic. (4)
- Start early in UPT and FT and continue in Flight Lead Training and IP upgrades. Instill CRM before the "captains and majors get their walls up." (14)
- "Don't make it kinder and gentler, touchy-feely stuff." (14)
- Emphasize "what" we're teaching instead of giving it the new name of CRM. (25)
- Stress how to "coordinate a four-ship", just like multicrew aircraft have to learn how to "coordinate the crewmembers on the flight deck." (27)
- Stress how to set things up in the cockpit and maximize effectiveness. (27)
- Since most of *CRM is common sense*, bring up examples of things that did not work, or things that worked well. (31)
- Keep the CRM training simple. (31)
- Emphasize "communication and briefings." (19)
- Stress that human factors are important in a risky business like this. (20)
- Do CRM training more often, certainly more than once a year. (22)
- Needs to be thought provoking. (28)
- Should be group oriented. (28)
- Should be every six months for an hour in duration. (28)
- Should include risk management and ORM. (28)
- "Concentrate on the human factors side, like, "why do people not do the right thing like 'speak up' at the appropriate time." (29)
- Make the objectives broader, so as not to be individual components. (32)
- Don't get wrapped around the axle with the components of CRM, but rather focus on the underlying issues. (32)
- Need to stress things pilots need to look for that will keep them out of trouble. (33)
- Keep CRM training short; the move from eight hours to four hours was good. (33)
- It is useful if you brief "crunch points," that is, points where things may go wrong. (34)
- Should be given in UPT in depth, then built-on in F-16 training. (36)
- If CRM training takes too long of a time, single-seat fighter pilots will go to it with a negative attitude. "The shorter you can make continuation training (one hour desired), the better." (31)
- CRM training is useful if it is done the right way and not just filling a square. It should be more frequent and not just annually. (34)
- Must stress that CRM is for everything, not just emergencies and contingencies. (12)

Leaders *must support* training

- Squadron Commanders, Operations Officers, and Weapons Officers must embrace it. (6)
- CRM issues should be covered often in briefings. (14)
- Present it as part of normal pilots' meetings. (24)
- It should be emphasized that while wingmen need to talk more, the flight leads need to stress in briefing that wingmen should ask questions and make comments if appropriate. (35)
- Energize Squadron Commander and Operations Officers to set the pace for the rest of the squadron. (19)

Use *simulators to reinforce* training

- Use more interactive training and less classroom. Need a PC-based, nonclassified, communications interactive, F-16 simulator for pilots to practice mission at home. (4)
- CRM should be incorporated into emergency simulators to see how the pilot uses the flight lead, SOF, etc. (25)
- Consider using "eye-trackers" in the simulator to stress CRM principles. (27)
- Use video playback of simulator or training device missions that include the "communication" between the players. (21)
- Change EP simulators so that the instructors will "play" SOF, etc. (30)
- Use the Unit Training Devices (UTDs) more. (13)
- Have simulator missions specially designed for CRM with multiple roles played by the simulator instructor off of a script stressing interflight and external communications (SOF, etc). (22)

Do not *"force" training* to be accomplished

- "We already have enough ground duties, don't increase them." (8)
- We do CRM already, we don't need to be trained to do it. (29)
- We should just "do" CRM, not "invoke" that we do it. (1)
- Do not change things and increase the workload of the instructors by forcing them to formally do something that they have always done. (8)
- Don't make CRM training something else "the guys have to do." (20)
- Integrate what is already being done in CRM without increasing the total time required of pilots or degrading other training. (8)

CRM *instructors* must have *credibility*

- Must keep credible (fighter experienced) CRM instructors. (3)
- Delivery of CRM training is very important; audience must relate to the instructor as far as background and knowledge. (24)
- Do not have the aerospace physiologist teach CRM because they do not have the credibility to F-16 pilots. Have F-16 pilots teach F-16 pilots. (32)

General comments.

- Keep training applicable. Use a format that "takes you out of the squadron and allows you to focus." (3)
- Stress all resources to help pilots. (19)
- Do not always address CRM in relationship to emergencies (like having other people read checklists, etc. (12)
- Add an item on student gradesheet which says: "flight lead/wingman utilization" to help evaluate EP and checklist usage. (25)
- CRM seems "detached from the rest of the training syllabuses; it should be integrated. (10)
- Recognize that the F-15 community has even more single-seat mentality than the F-16. They are slow to change from the old mentality. (18)
- Must be an on-going process throughout training. (21)
- Discussing mishaps is a good attention-getter, but you have to realize that "hindsight is always 20-20." (35)
- Stress coordination between all players. (22)
- Consider ops doing some CRM with maintenance personnel. (33)
- Recognize that since you cannot teach maturity, it will take time to learn the applicability of CRM. (34)
- People need to recognize that it is still an "individual call" by the flight leads on whether he will allow the wingman to talk on the radio. (34)
- Since CRM deals with emergency procedures, it should be discussed during the "emergency of the day" in the flight briefing. (26)

Assessment of Learning Styles (n = 35 assessed)

Visual (n = 9, 25.7%)

Respondents: (12) (14) (10) (30) (35) (19) (23) (29) (34)

Representative Respondent Remarks:

- Visual, followed up by flying. (30)
- Must see it, instead of hear it. (35)
- If I can see a good demo or a picture, I can recreate it later. (34)

Auditory (n = 0, 0%)

Respondents: 0

Hands-on (n = 17, 48.6%)

Respondents: (1) (2) (6) (25) (26) (5) (7) (9) (11) (15) (16) (17) (21) (8) (13) (20) (33)

Representative Respondent Remarks:

- I have to read a little, but I need to be hands-on to really learn. (1)
- I am slow to learn right away, but when I touch something, my learning accelerates. (2)
- I learn by "doing it." (6)
- Must write or do the task to learn. (26)

Hands-on/Visual (n = 6, 17.1%)

Respondents: (3) (4) (31) (18) (22) (36)

Representative Respondent Remarks:

- Hands-on for flying, visual for systems. (18)
- Visual learner with hands-on a close second. (22)

Visual/Auditory (n = 3, 8.6%)

Respondents: (24) (32) (27)

Representative Respondent Remarks:

- Must do both. (27)

No Assessment Made (n = 1)

Respondents: (28)

APPENDIX G

CORE CRM BEHAVIORS DATA COLLECTION
(Interviews with F-16 Instructor Pilots, Leaders and Students)

Open Coding of Data

As the qualitative data were collected, reoccurring themes and descriptive words were used to code similar topics together to form data coding. Coded data were later represented in various matrix forms to aid in cross-referencing the responses. Using grounded theory, the data analysis included open coding, which involved determining what themes and categories emerged from direct responses from the F-16 IPs, unit leaders, and F-16 students (Creswell, 1994). The key phrases were collected and coded into meaningful categories. Although all key phrases were considered for use in the narrative, the following phrases evolved as primary coding categories for comparative analysis. This data has not been axial coded into further reflective topics.

Opening Coding Topics

Attitudes on Mission Planning/Debrief

Flight Planning and Briefings

- Brief a good plan and then fly as briefed. (9) (25) (29) (31) (36)
- Important to tailor the flight to the lowest common denominator. (1) (4) (20) (24)
- IPs need to read the grade books on all the students in the flight. (1)
- "Squadron standards" are taught for whom is responsible for which duties. (2) (6) (32) (36)
- Everyone must get involved in the plan. (2)(3)(31)
- Must brief task prioritization: visual 1st, formation 2nd, etc. (4) (6)
- Build "smart materials" to carry into the cockpit which help you, but don't overload you. Then use those materials to "chair-fly" the mission. (6)
- Priorities and weather are covered. (12)
- CRM is never talked about, but issues are covered. (11) (12) (14) (18) (21) (22)
- Briefing is directed from the flight lead. (25) (35)
- Incorporate emergency procedures and loss of visual in briefings. (26)
- This involves where you put stuff in the cockpit. (22) (27)
- When flying air-to-air, there is not much CRM briefed, but in air-to-ground, there's more CRM subjects covered. (5)
- Planning is taught in UPT, but not much by IPs in formal training. (7)
- It is hard to label what is CRM, what it is saying, what is going to happen, and what the priorities are. (10)
- Focus mostly on route study and relying on each other. (21)
- Not much covered except for general comments. (30)
- We do what we need to be successful. (8)

- Students need to know what the "priorities" are. (13)
- Delegate responsibilities so that the students do most of the planning. (32)
- A lot of assumptions have to be made, like: is everyone ready to fly, do they have the required crew rest, etc. (33)
- Does <u>not</u> follow "squadron standards" for flight planning responsibilities. Because of student experience levels, normally lets people volunteer for different tasks. (34)

Debriefing

- CRM issues discussed primarily to assess what went wrong. (2) (3) (10) (11) (12) (21) (31) (32) (33) (35)
- Need to focus on how well a student "executed" the objectives of the mission. (1) (4)
- Need to assess if training rules were followed. (1) (6)
- Need to assess communication, situational awareness, task saturation/management. (1)
- It should be emphasized that there is "no rank" in a debriefing. (1)
- Safety aspects should always be emphasized. (1)
- Place where CRM comes into play: "If they're not managing their cockpit, they bust the ride." (6)
- Assess if they always had "the big picture." (6)
- Assess if they were prioritizing correctly. (6)
- Debriefing is more of a "discussion" of what was done. (25)
- Debriefing involves discussion of techniques to improve. (27)
- In debrief, the entire tape is <u>never</u> reviewed because of lack of time; accordingly, some CRM behaviors might be missed. (18)
- Debriefings are good from a review of the flight perspective. (13)
- CRM in debrief is <u>not</u> a large factor; you only assess what happened – good or bad. (20)
- During the debriefing, the outcomes and lessons learned are covered to make ourselves better. Sometimes the squadron weapons officer disseminates the lessons learned. (36)

Attitudes on Crew (Flight) Coordination/Flight Integrity

Roles of a four-ship flight leader

- Primary leader and decision-maker for the flight. (2) (3) (5) (7) (11) (14) (21) (22) (23) (24) (25) (29) (30) (34) (35)
- Responsible to get the mission accomplished and keep everyone safe. (1) (8) (12) (19) (20) (24) (27) (29) (30) (31) (32) (33) (36)
- Lead must be ready to implement contingencies. (5) (7) (12) (14) (18) (22) (33)
- Conduct a good brief and debrief. (1) (8) (10) (12) (26)
- Encourage flight members to speak up. (1) (23) (25) (26) (35)
- Maintains situational awareness for the flight. (1) (9) (14) (18) (22) (31) (36)
- Know flight's capability and adjust accordingly. (9) (12) (13) (31) (36)
- Provides "integrity" for flight. (2)
- Makes sure everyone knows their "role" in the four-ship. (3)

- Lead "supports the wingmen" when needed by reading the checklist, flying wing, and making recommendations. (4)
- Four-ship must be integrated. "Without integration, we lose wars." (6)
- Keep plan simple. (6)
- Know the standards. (6)
- Employ effectively and achieve briefed goals. (27)
- Flight lead has the hammer for the flight, but anyone can knock-it-off. (25)
- Stress good communication. (26)
- "Needs to fly the plane without thinking and think about others in the flight." (5)
- Competent pilot himself. (10)
- Has the experience to be an example to the rest of the flight. (18)
- Administrative functions. (23)

Roles of an element leader

- Responsible for number four. (1) (3) (9) (10) (11) (19) (22) (23) (27) (30) (33) (34) (36)
- Maintain integrity with number four. (31)
- Backup for lead. (1) (7) (14) (18) (19) (21) (22) (23) (24) (26) (27) (29) (31) (35) (36)
- Ready to take over the flight if lead drops out. (2) (3) (4) (12) (14) (36)
- Pickup secondary roles as directed by lead or as a split-off element. (4)
- Critical for flight integrity. (6)
- Same as lead, but he is expected to speak up if he sees anything going wrong. (25)
- Interact with the flight leader. (31)
- As tasked by lead. (9) (18)
- Works with lead as a team. (10)
- Good follower. (10)
- No decision authority in the flight, just advisory. (30)
- Ensure team efficiency to obtain objectives. (8)
- Help meet objectives as established by lead. (33)
- Expected to have more situational awareness than wingmen. (8)
- Provide support to lead during emergencies, aircraft malfunctions, and decision making. (8)
- Fly his own jet first, then backup lead. (13)
- "He had better support lead's game plan or lead should 'rip his head off." (20)
- Alternate flight leader and decision maker to safeguard the leader. (22) (23)
- Telling lead if he is doing something wrong or is missing something. (29) (32)
- Clarifying the situational awareness ("the picture") if needed. (29)
- Tries to read lead's mind and support what he wants. (34)
- Support the game plan. (36)

Roles of a wingman

- Maintain good situational awareness. (1) (7) (8) (10) (12) (22) (25) (31)
- Stay visual. (1) (14) (19) (22) (24) (29) (32) (34)
- Stay in position. (5) (7) (9) (19) (22) (24) (29) (30) (34) (35)

- Know the plan and fly as briefed. (3) (10) (11) (12) (14) (20) (21) (23) (26) (27) (35) (36)
- Be willing to speak up when necessary. (1) (3) (4) (7) (10) (12) (18) (27) (29) (33) (35) (36)
- Support the flight lead. (2) (24)
- Know how to "be part of the team." (6)
- Know what the flight lead wants and how to contribute to the flight. (6).
- Sound smart on the radios. (24)
- Put bombs on target. (24)
- Try to stay two steps ahead of where the flight leader is. (25)
- Be safe. (31).
- Do basic mission planning. (31)
- Know what the plan is and the thought process for the plan. (5)
- Know what the flight lead wants. (5)
- "QC what the flight lead is doing. (5)
- Be on the radio frequency. (9)
- Be ready to take over lead if necessary. (9)
- Be able to adapt to situation. (9)
- Tries to learn from watching the flight lead. (10)
- Look out for anyone who is task saturated. (10)
- Know your place, but do not let something go by that you could have prevented. (21)
- No one is exempt from a bad day, so the wingman must be able to do something if lead has problems. (21)
- Keep a good visual search. (30)
- Provide mutual support for rest of flight. (30)
- Be mentally prepared and check prerequisites. (19)
- Be ready to fly, mentally and physically. (19)
- Be involved in mission planning and prepared for his part of flight briefing. (19)
- Be ready for the debrief and tape rewound. (19)
- Speak by exception. (23)
- Assist with emergency chase. (23)
- Do as he's told. (23)
- Make sure that the leader does not get killed from air-to-air threats or ground-to-air threats. (32)
- It depends on experience level. Experienced wingmen can do more than new wingmen. (33)
- Assist in accomplishing the mission objectives. (33)
- Do not hit anyone. (34)
- Support lead/three. (34)
- Do not second-guess lead/three. (34)

At what point does a wingman question or nonconcur with a flight or element leader's action or decision

- If safety of flight dictates. (1) (2) (3) (5) (8) (9) (10) (11) (12) (13) (14) (21) (22) (23) (25) (26) (29) (32) (34) (35) (36)
- If comfort level is exceeded. (1) (25) (31) (35)

- If there is something important that needs to be brought to the attention of the flight. (26)
- If fuel becomes an issue. (25)
- If rules (training or ROE) are violated, or are about to be violated. (14)
- To clarify a situation or build situational awareness. (1) (36)
- "Wingman is responsible for his jet, he cannot let the flight lead put him in corner." (3)
- When <u>information</u> needs to be passed to lead to build situational awareness and when communicating a <u>suggestion</u>, but *never* any <u>direction.</u> (4)
- *Some pilots still in old school:* wingman keeps quiet and does not garbage-up the radios. (6) (26)
- *Most pilots lean toward new school:* Let the wingman speak up and build experience to know when to talk. Some people use the term "free-call," meaning: if you don't like something or want to highlight something, you call it out. (6) (26)
- If it looks like a life-or-death situation, wingmen should speak out. However, if it is not appropriate, think about it, and talk about it in the debriefing. (6) (24)
- If unclear on what is supposed to be done. (14)
- If something is different that what was expected, asks for clarification. (27)
- This is based on the experience level of the wingman, as to whether they can "know" that something is going wrong. (31)
- "Sometimes, flight leads brief for wingmen not to say anything except 'two.'" (5)
- When the wingman can offer some missing information. (5)
- If it is <u>not</u> a dangerous situation, make a note and discuss it in debrief. (9) (10) (11) (21)
- Before you say or do anything, make sure you have all the factors. (10)
- Try to be trusting of your leader, but save your own jet at all costs. (10)
- Rank should not be a factor. (21)
- Never seen that situation. (18)
- It does <u>not</u> matter how you say it, diplomacy should not be a factor. (21)
- "If you see anything that is dumb, dangerous, or different." (30)
- It is very hard to do. Told from the very beginning in Introductory Fighter Fundamentals that the flight lead is "God" and whatever he says goes. (30)
- Unbriefed actions, which are not safety of flight, should be "noted" and covered in the debriefing. (8)
- If a wingman sees something that needs to be communicated for situational awareness (e.g., bandits not previously called out). (8) (20) (29)
- Fill in the blanks in the flight. (20)
- Be active participant, don't be a "water skier." (20)
- Be "directive" for anything that relates to wingman's own plane. (8)
- Lead must "honor" a wingman's call, but then talk about it in debrief as to whether it was a right or wrong call. (13)
- When task saturated and have a problem keeping up, speak out. (19)
- "Error on saying too much," instead of too little. (19)
- Can't let an overpowering leader keep you from saying something. (19)
- Speak up in the briefing if something is wrong. (33)
- In the air, speak up immediately if something does not look right. (33)

- If the leader does not concur with the wingman's comment, he owes the wingman a response so he knows what is going on. (33)
- If they do not like the "flow" of what's happening, that is, it is dumb, different than briefed, or dangerous, speak out. (34)
- A wingmen has to trust the lead up to a point. (36)

How does a wingman question or nonconcur with a flight or element leader's action or decision (what does the wingman "say")

- Be directive: "Terminate" or "knock it off." (1) (7) (12) (13) (14) (18) (31) (32) (35) (36)
- Ask a question. (2) (9) (11) (12) (14) (24) (29) (36)
- Make a statement in plain English. (2) (4) (5) (7) (9) (19) (20) (21) (22) (23) (25) (27) (29) (31) (30) (33) (34) (35)
- Diplomatically hint to lead: "two is 4000 lbs" instead of "lead, you forgot the ops check," or "alpha check to bullseye" instead of "lead, you just went out of the area." (24)
- "Lead, I'm not comfortable with...." (25) (27)
- Leading Comment: "Lead, check altitude...." (26)
- "Free-calls" from anyone in flight, like "cameras on". (26)
- Suggestion: "Lead, suggest we hook left....(31)
- Comment to gain attention: "Lead, Two shows boundary three miles north." (31)
- Ask for "clarification" from lead. (10)
- The *tone* of what is said is more important than the words used. (35)
- Request: "Lead, request that....." (34)
- Statement: "Lead, that is unbriefed....". (34)
- If not critical, find the right "time" to ask the question. (36)

Attitudes on Risk Management/Decision Making

How does a flight leader assess risks in a four-ship

- Consider experience and ability of flight members. (2) (8) (13) (14) (20) (24) (25) (26) (29) (30) (31) (33) (34)
- Starts on the ground. (2) (7) (9) (10) (12) (14) (18) (21) (23) (27) (31)
- Consider weather: it may be legal, but on the edge. "Ask if everyone in flight is comfortable." (1)
- Sometimes the flight lead must call a "knock-it-off," even if it is legal. Some pilots may not say anything even if they are uncomfortable because they do not want to be thought of as a wimp. (1)
- Flight leads must emphasize that it is ok for flight members to say that they are not comfortable. (1)
- Number 1 is in charge and makes the call, but number three has a vote. Number one should ask #3 if he has any doubts. (3).
- In "ORM" you think about a "risk assessment chart" and going through it. You can do some of this in mission planning, but you cannot do this during actual flight operations. (6)

- Knowing "what we are going to do, and can we do it." (12)
- Problems like communications, situational awareness, etc., might require a reduction in the difficulty of the mission. (12)
- Need to determine how long you can let something go to learn something, in contrast to letting it go and waste the gas. (26)
- Listen to how wingman sounds on the radio; if he's missing radio calls, he is probably task saturated. (27)
- Keep the big picture to make decisions. (5) (10)
- Stay away from air-to-ground threats. (7)
- He considers the weather, mission objectives, and syllabus. (11) (35)
- No formal "numerical risk assessment" like in ORM. (11)
- Risks should be assessed based on the situation. (21)
- Consider the mission (wartime or training). (30)
- Consider the environment (weather, etc.). (30)
- The training rules are important to most risk assessment situations. (35)
- Look far enough forward to assess risks and avoid a "square corner." (8)
- Listen to radio to hear if someone is overtasked. (13)
- Listen to radio to hear if wingman is <u>not</u> responding to calls, indicating that they are task saturated. (29)
- Watch formation to see if everyone is flying the game plan. (13)
- Flight leader should use all of his resources (element lead, SOF, Top-3). (19)
- "Identify whether it's a risk or just the cost of doing business." (32)
- Look at all of your options and then make the decision. (32)
- Ask for suggestions from other flight members. (34)

How does a wingman assess risks and make decisions

- Know your own limitations and whether you can handle the task; if not, speak up. (1) (24)
- Stay focused on "personal limitations." (2)
- Prioritize actions and stop when risk is too great. (2) (4)
- This is very "situational" in a single-seat fighter. You must just weigh the risk of what is actually happening at the time. (6)
- It is based on personal comfort level. (25)
- Watch your own capabilities and be willing to "knock-it-off" if needed. (31)
- Wingman will be less assertive because he may <u>not</u> have the big picture. (5)
- Know lead's game plan. (7)
- Keep big picture. (10)
- Make sure you feel good physically. (30)
- Do your G-awareness turns. (30)
- Make sure you are emotionally fit and have your "head-in-the-game." (30)
- Stay ahead of the aircraft and do not overextend capabilities. (8)
- Listen to radios for important information. (13)
- The wingman needs to trust the flight lead, but only so far. Then he must take responsibility for his own action. (32)

At what point does a flight leader ask for recommendations/ comments" from outside the flight?

- Keep it within the flight whenever possible. (3) (9) (18) (20) (21)
- When things don't go as planned. (4) (8) (22) (23) (29)
- Contact the SOF for emergencies. (9) (10) (26) (27) (35)
- Contact the top three for additional info (rules, weather, maintenance, procedures). (3) (8) (11) (18) (22) (23) (27) (29) (35)
- If they are confused or messed up (like question on training rules), they should ask another member of the flight. (1)
- When they are overwhelmed or stumped. (1) (4)
- "People are more comfortable now with asking questions than in the past." (1)
- "As soon as he needs it. (2).
- "If there is any risk (if I have to think for more than 5 seconds) I will ask a question" (SOF for weather and alternates/ Top-Three for procedures and rules. (3)
- When they need more information. (4)
- People don't want to "look stupid" and would rather do it on their own because of their fighter pilot mentality. (6)
- Need more humility in flying and "fess-up" more. (6)
- If a flight lead ask for recommendations in front of students or wingmen, it "sets the example." (6)
- Should talk to Top-Three prior to the briefing to see he has anything important to consider. (12) (14)
- In the air, never ask advise from the SOF or Top-Three, but listen to their information for your own decision. (12) (25)
- Go to the SOF anytime there's a need for "a relaxed, informed recommendation." (24)
- Go through the checklist with the SOF. (26)
- Never ask the SOF for a recommendation. Only tell him what your are going to do and then let him suggest a different approach if he has more information. But the flight lead in the air makes the final decision. (31)
- Only if there is time. (5)
- Did not know of a situation where the flight lead would ask for information or a recommendation, but realized that there might be. (7)
- Mentality today is that "it's a one-mistake Air Force," so check with someone else who is not flying like the SOF or Top-Three. (21)
- Flight leads are not invincible, they should check on something if they have a question. (30)
- If there are sources who have more or better information than the flight lead, the flight lead should use them. Those sources are at zero knots and 1-G, so they are in a good position to do the research and make recommendations. (35)
- Talking to SOF and Top-Three is for advisory only, the flight lead makes all decisions. (13)
- Whenever it is needed (weather, importance of training, etc.). (19)
- "There is too much supervision micromanagement going on. Too many guys call the SOF or Top-Three. We push guys too far to get others to make their decisions for them." (20)
- Number one should pass number four's problems to number three to work/monitor. (29)
- Anytime the mission cannot be conducted in a safe manner. (32)

- Anytime the flight lead can get "real-time information," he should go to that source. (32)
- If he needs clarification on a rule or regulation. (33)
- Ask someone if you have a question and don't know the answer: "knowledge is power." (33)
- A day or two before the flight when the names go up on the scheduling board. Check flight members' experience and currencies and get the latest tactics for the mission. (34)

Attitudes on Task Management

How does a flight leader distribute tasks and workload within a four-ship?

- Start with mission planning/briefing. (1) (4) (5) (8) (10) (11) (12) (19) (20) (21) (22) (23) (29) (33) (34) (35)
- Know abilities of flight and distribute accordingly. (2) (6) (7) (19)
- Use squadron standards. (3) (4) (8) (9) (19) (20) (22) (23) (25) (26) (27) (31) (33)
- Use element leader. (3) (14) (25) (26) (27) (32) (33) (34)
- If you have to change duties, brief it on victor (inter-flight radio). (1)
- Give a new game plan if things are not going as briefed. (1) (12)
- In the air, *brief a new, simple plan* if things are not going as briefed. (31)
- Make changes as early as possible to give people a chance to think about it. (1)
- In the air, risk assessment must be made by the most experienced pilot, and the wingmen must trust their lead unless they have more information. (4)
- In air-to-air engagement, Acceptable Merge Risk (AMR) must be predetermined and considered. (4)
- "More critical in an operational unit than a training unit. (6)
- In the air things change and flight lead may distribute tasks. (9)
- Minimize changes in flight. (10)
- "Flight lead can call an audible in the air but it must be acknowledged." (11)
- Pass off additional or new tasks and duties on the radio. (35)
- Establish radar sort responsibilities. (18)
- Renumbering the flight requires a "briefed" reshuffling of responsibilities. (18)
- Give specific tasks to the wingmen (like sorting targets) to decrease the flight lead's workload. (30)
- Expect wingmen to ask in the briefing if there are any questions about their responsibilities in the flight. (8)
- Stick to the standard tasks game plan as briefed, but when calling an audible, you can send wingmen to check weather, etc. (13)
- Do "visualization" in your mind while looking outside. (19)
- "Do not keep secrets;" let everyone in flight know what is happening. (20)
- Give wingmen as many "black-and-white" decisions as possible. (20)
- Monitor the wingmen to make sure that they are not getting task saturated. (22)
- Delegate tasks in flight (such as during a divert, distribute responsibilities like communication, alternates, ranges, gas, etc.). (29)
- It depends on the complexity of the task. Number 3 gets the complex tasks, and 2 and 4 get the easy tasks. (32)

- In the air, if he can do it himself, he should. The next person who should be tasked is Number 3 (to change frequencies and check on things, etc.). Three can delegate some of the tasks to 4. (33)
- If a two-ship, keep Number 2 on the frequency and Number 1 jumps around the frequencies to gather information. (33)
- Leads should listen for missed radio channel changes and fuel checks to determine if someone is overtasked. (33)
- Do not hit the rocks, other airplanes, etc. (34)

How does an individual pilot handle task and workload management?

- Prioritize (aviate, navigate, communicate). (1) (2) (3) (5) (9) (10) (12) (13) (14) (18) (24) (25) (27) (29) (31) (33) (35)
- Prepare in advance. (5) (7) (10) (19) (29)
- Know your limitations. (2) (14) (20)
- Slow things down and reduce tasks. (1) (33) (35)
- Organize. (19) (21) (34)
- Know the "clues" that you are approaching the edge of your envelope and how to communicate that you are "unable" to do that particular tasking. (2)
- Must quickly learn the best way to do "cockpit tasks." (4)
- Do not let a wingman or a leader drag you into something that is going to get everyone in trouble. (14)
- Missing radio calls is the first cue of pilot overload. (24)
- Remember responsibilities: "Don't hit the ground and stay in formation so you don't cause any problems for lead." (26)
- Ask lead if there is every a question. (27)
- "Do the best I can." (7)
- Focus on flying the jet. (9) (18) (35)
- Say "unable" on radio if you are overloaded. (9)
- "I talk to myself a lot to try to remind myself what's next and what my priorities are." (11)
- Do the emergency procedure "CAPs" as soon as you can. (18)
- Don't concentrate on any one thing too long. (30)
- Keep your eyes moving. (30)
- Use "reminders" (like turning on the HUD reticle) to remind you about switches, etc. (30)
- Do not hit ground or anything attached to it and don't hit each other. (8) (23) (29)
- "Fly own airplane first." (13) (33)
- Support lead's game plan. (20)
- Realize when you are getting behind, are task saturated, and have channelized attention. (22)
- Consider yourself in the worst situation and think about what you might do. (29)
- Use acronyms for *memory joggers* and pacing to accomplish the correct task at the correct time. (32)
- Be able to recognize task saturation, channelized attention, and complacency, and figure out where you are most likely to encounter them. (34)

Attitudes on Communication

Types of factors that cause a breakdown in interflight communication

- Not speaking up when necessary. (1) (8) (9) (11) (12) (21) (26) (31) (35)
- False assumptions. (1) (2) (7) (31) (35)
- Personality issues. (2) (3) (5) (6) (14) (19)
- Individual task saturation. (4) (11) (23) (25) (34)
- Poor radio discipline. (5) (6) (9) (10) (13) (14) (20) (33)
- Equipment problems. (4) (20) (27) (31) (36)
- Improper use of terminology. (6) (10) (12) (13) (14) (18) (20) (22) (23) (26) (30) (34)
- When things don't go as planned. (6) (7) (23) (25) (27) (29)
- Saturated radios. (9) (10) (12) (13) (24) (27) (34) (36)
- Misleading radar calls which hurts situational awareness (e.g., calling threats off bulls-eye point vice flight position). (1)
- Poor situational awareness. (2)
- Lack of confidence/security/experience. (3)
- Missed radio calls between flight members. (3)
- Voice recognition and nicknames sometimes help in task saturation. (4)
- Similar call signs. (4)
- Lack of flexibility when changing a plan. (6)
- Not knowing the other members of the flight's voices. (6)
- Different people just sometimes have "bad days." (6)
- Missed communication (UHF/VHF interference). (12)
- Someone in flight loses a visual or radar contact. (25)
- Using the wrong bulls-eye to call-out threat. (26)
- Communication loss. (7)
- Not getting what you want across. (7)
- Someone doing something different than they are saying. (10)
- When people are <u>not</u> concise in what they say and use too many words. (21)
- Flight lead who is not calm on the radio. (30)
- Wingmen who are not calm on the radio. (30)
- Wingmen not understanding their responsibilities. (8)
- Communication by sender not clear to the receivers. (13)
- People who do not keep up with tactical changes by insisting that: "this is the way we've always done it...." (19)
- People may not be "perceiving" a situation the same. (22) (33)
- Not using plain English when it is needed. (34)
- When person with emergency has a low experience level. (29)
- When the traffic pattern is busy. (29)
- Unstated goals and objectives in the briefing. (32)
- When people walk out of a briefing with unanswered (or unasked) questions. (32)
- Ambiguous briefing by the flight lead. (33)
- A distraction in the aircraft, like, dropped a map, cannot set radio frequency, etc. (34)

Types of factors that cause a communication breakdown with other flights or controlling agencies

- When things don't go as planned. (1) (5) (14) (19) (33)
- Lack of situational awareness. (1) (4)
- Equipment problems. (1) (2) (4) (8) (10) (21) (23) (29) (32)
- Improper terminology. (2) (5) (6) (8) (21) (22) (36)
- Poor radio discipline. (3) (6) (8) (9) (12) (18) (22) (24) (25) (26) (27)
- Lack of experience. (6) (7)
- Not speaking up when you should. (14) (26)
- Saturated radios. (20) (27) (34) (35)
- False assumptions. (25) (27)
- When GCI/AWACS creates questionable situation, additional communication is needed to re-sort the tactical picture. (1)
- What was said was not what was received (GCI/Strike force interpretation). (2)
- Language barriers (between different countries). (4)
- During communication between different fighter communities, services, or countries, not everything said means the same thing to everyone else. (6)
- "Close sounding call signs." (12)
- People focusing only on their own problems. (14)
- Lack of standard communication at a critical point. (25)
- Not using plain English. (25)
- A player using nonstandard communication. (26)
- Not having a well-briefed communications plan between the different players. (31)
- Controlling agency not understanding what you need. (9)
- Rivalry between over aircraft/flights for ATC attention. (9)
- Both UHF and VHF transmissions at the same time. (10)
- Lost situational awareness from either direction. (11)
- Different cultures, like during Desert Storm. (21)
- Miscommunications with ATC. (30)
- Players not knowing "what to say." (13)
- Complexity of the plan: "complex plans work one time out of ten." (19)
- Misunderstanding the communication plan and the overall game plan. (20)
- When someone mislabels a group. (29)
- When someone says something stupid that "dumps everyone else's situational awareness. (29)
- Not all the players know the plan. (32)
- Briefing must cover all the contingencies for all of the assets. (32)
- Radio out assets should be sent home. (32)
- Threats. (33)
- Stress. (33)
- People not being where they are supposed to be. (33)

- FIXES: Use victor frequency for internal flight communication and UHF for controlling agency or package communications; think first, then say it; use plain English; listen to what is going; and keep sight of lead. (33)

Attitudes on Situational Awareness

What a flight leader can do to improve situational awareness

- Good briefing and/or planning. (1) (3) (6) (7) (9) (10) (24) (27) (31) (33) (35) (36)
- Good communication, keep everyone informed. (1) (2) (3) (5) (6) (8) (10) (11) (12) (13) (14) (18) (21) (23) (24) (25) (26) (27) (29) (31) (32) (33) (34) (35)
- Keep the plan simple. (2) (20)
- Fly the plan as briefed. (8) (9) (10) (12) (19) (36)
- Offer information as briefed, without overloading communication. (1)
- Take time to focus attention so information can "sink-in." (2)
- Attention to details. (2)
- Use JTIDS, AWACS, ELINT information, and Joint STARS. (4)
- Worst Problem: When some people (like intel) know something, but do not pass it on to the people executing the mission. (4)
- Use Data Link. (4) (14)
- Keep the big picture through target sort, visual, and listening to radio calls. (6) (12) (26)
- Make sure everyone knows the priorities for each mission segment. (6)
- Do not overload inexperienced wingmen with too much information. (14)
- When the briefed plan is breaking down, lead must tell the rest of the flight what the new plan is. (24)
- If a pilot breaks a habit pattern, go back to the last point before the pattern was broken. (25)
- Know the contingencies for flight/element split up. (26)
- "75% of situational awareness is knowing what is going on." (27)
- Minimize the flight member taskings so that they have enough time to focus on what they will have to do. Keep the plan simple. (27).
- Know what the picture is going to look like on the radar and where everyone is going to be. (31)
- Know what the altitude and the timing deconfliction is. (31)
- Everyone needs to *what* the plan is and *why* the plan is the way it is so when things pop-up and you have to be flexible, you can anticipate what the flight lead may want to do. (5)
- Fly with the same people whenever possible, so people think the same. (5)
- Understand what you're doing before you go fly. (7)
- Stay ahead of what you're doing. (7)
- Keep the big picture. (9) (10)
- Help build the big picture for everyone in flight. (10)
- Give directions to keep flight in formation. (10)
- Understand the plan (tactics, execution, etc.). (8) (13)
- Following wingmen and flight lead contracts. (8)
- Anticipate what is going to happen and communicate it to the rest of the flight. (29)

- Experienced flight members. (8)
- If the flight lead can tell that a wingman went "tumbleweed," he needs to tell the wingman what to do next to get back to the plan. (8)
- Be "brief" on the radio when building situational awareness. (13)
- Delegate search responsibilities. (13)
- Get the big picture and communicate it to flight. (13) (34)
- Get data-link for all information, from wingman fuel to location of all players. (13)
- Good use of radar search and air-to-air TACAN. (19)
- If radio calls indicate that flight is losing situational awareness, back off, or knock-it-off, and let everyone catch up. (19)
- Listen to what is being said to build the "big picture." (20)
- "Take your time and get there faster." (23)
- Build the picture using radar/visual and communicate the picture to flight on VHF. (33)
- "Funny thing about situational awareness, you don't know that you have lost it until you get it back." (33)
- At night or in weather, put flight in radar trail if needed to give them time to build their situational awareness. (33)
- Verbally help wingman with radar work if needed. (34)
- Give the wingman a verbal description of what his aircraft is doing if he is disoriented. (34)
- Adapt the plan if needed. Give audible changes and allow the wingmen to "reconfirm" if they have any questions. (36)

How can situational awareness be improved in a multiforce package?

- Really needed after a threat reaction. (19)
- Use radio communication to rebuild situational awareness (bulls-eye calls, next steer point, etc.). (19)
- Use a simple game plan that is understood by all agencies (ATC, GCA, etc.) and executable by everyone involved. (20)
- Everyone up on a single-strike frequency (iron-haulers, air-to-air, and AWACS. (20)
- Use AWACS as a communication bridge if needed to communicate with other players, but realize that it will increase time delay. (20)
- Using data-link will speed things up. (20)
- "Keep your mouth shut and listen." (23)
- Limit communication to prevent "trashing everyone's' situational awareness" by hogging the frequency. Use victor for interflight communication. (34)
- Stay with scripted maneuvers and try not to call audibles. (29)
- Communicate to the rest of the package if you have to pull out of the "train" if it's not part of the script, then call when you are back in position. (29)
- Call out briefed and nonbriefed threats to the rest of the package, even if they are not a threat to your flight. (29) (32)
- If the package loses sight of the big picture, then someone needs to speak out. (33)
- The package commander must provide the picture and listen up to check-ins to make sure all of his players are there. (33)
- Four-ships must be where they were told to be so that everyone else has the big picture. (33)

- So much comm chatter decreases the situational awareness. Focus on the game plan and execute. (36)
- If deviating from the game plan, broadcast it (route, timing, etc.) on UHF, if you can make a transmission, then get back to the game plan as soon as possible. (36)
- Talk to your flight only on Victor. (36)
- A flight has to stick together – always. (36)

What can an individual pilot do to improve situational awareness?

- Listen and build a mental picture. (1) (3) (11) (12) (14) (20) (23) (30)
- Prepare (study, chair fly, etc.). (2) (21)
- Stay visual and/or in position. (3) (27) (31) (33) d
- Prioritize tasks. (3) (4) (5) (11) (13) (14) (18) (19) (24) (27) (29)
- Be willing to speak up. (12) (25) (29) (31) (33)
- "Get excited about your role." (2)
- Ask a question if you are not sure. (12)
- Have bullseye set to the nearest divert unless needed for air-to-air engagements. (31)
- Know what's going to happen before you step out the door to fly. (31)
- "Always think ahead; don't just put out the fire-of-the-second." (5)
- Keep ahead of the jet and review what is ahead. (10) (30)
- Have a game plan and good habit patterns. (5)
- Know what was briefed for the plan and understand it. (9) (10)
- Keep the big picture. (9)
- Do not get focus fixed on any one thing. (10)
- Have a good attitude; be happy and unstressed. (10)
- Use all of the equipment available. (11)
- "You do not know that you have lost situational awareness until you get some back." (18)
- Go back to basics and keep it simple. (18)
- Do not just fly your jet. If you are always "backing up the flight lead," you will have situational awareness. (21)
- Use *Data Link* and *Moving Maps*. (35)
- Be ready to go when you "push." Verbal communication breaks down when the engagement starts. (35)
- Constantly ask yourself about what is happening and what lead might do next. Then analyze why things did not happen the way you thought. (35)
- Fall back to the plan in the briefing. (8)
- Fly airplane and formation first. (13) (29)
- Build situational awareness by moving away from the situation if necessary (horizontal and vertical space), using priorities, radios, and radar. (19)
- Be ready to take over lead at anytime. Do not get lazy on the wing. (20)
- Build a picture from "outside the cockpit" to "inside the cockpit." (32)
- Look at the game plan and the tactic. (32)
- Cockpit organization: where do you put things and what do you write on, etc. (33)

- Keep up with the steer points. (34)
- Use big visual references because you probably will <u>not</u> have time to read a map. (34)

Attitudes on characteristics of effective flight leaders

- Good overall leader. (1) (14) (33)
- Has good knowledge about aircraft and tactics. (1) (3) (5) (13) (18) (21) (24) (30) (33)
- Organized. (1) (2) (33)
- Has a good personality, gets along well with others. (1) (5) (7) (9)
- Has a lot of charisma. (2) (3) (5) (9) (10) (18)
- Good overall communicator. (2) (4) (6) (7) (12) (19) (20) (26) (30) (32) (35)
- Has good situational awareness. (6) (7) (24)
- Good briefer/debriefer. (4) (9) (12) (13) (19) (20) (26) (33) (35)
- Encourages flight members to speak up. (9) (27) (29) (30) (31) (35)
- Stays ahead of jet, because he is making decisions in advance. (1)
- Selfless; focused on the mission. (2)
- Proactive. (3)
- Honest when he does something wrong. (3)
- Analyzes the flight members and gives a good mission briefing which sets the tone for the flight. (24)
- Fly together frequently and build a team where people "think alike" (like ANG pilots). (4)
- Good judgement. (6)
- Initiative and aggressiveness to make decisions. (6)
- Good prioritizer. (6)
- Good task manager. (6)
- Good wingman consideration. Has been a good wingman, so he understands wingmen needs. (12)
- Not necessary to be the best pilot, as long as they can brief and fly well. (12)
- Fly what is briefed. (12)
- Delegates well. (14)
- Never stops learning. (25)
- Thinks for flight, not just himself. (25)
- Provides flexibility for wingmen to speak up. (26)
- Be decisive; make quick, confident decisions and stick to them. (31)
- Be directive to the rest of the flight. (31)
- Motivated. (5)
- Everything happens in accordance with the plan. (7)
- "Leaders who are behind the power curve are not respected. (7)
- Recognizes how rest of flight is doing and offers helpful corrections. (10)
- Willing to point out and debrief his own faults, as well as the rest of the flights'. (10)
- Creative to find different ways to accomplish the mission; thinks outside the box. (18)
- Knows how to fly his jet. (21)
- Know everyone's limitations and then tailor the mission to be within the confines of everyone's abilities. (21)

- Has a calm attitude. (30)
- Can manage the tasks required. (8)
- Thinks ahead. Has forward vision to see where errors might occur and can minimize. (8) (13)
- Remembers his priorities: aviate, navigate, communication. (13)
- Must understand the limitations of the guys in the flight. (20)
- Does not have to be the world's great stick, but must be able to assimilate a lot of information and make good decisions. (20)
- Uses the KISS principle. (20)
- Keeps track of the execution and the contingencies (weather, etc.). (20)
- Technically competent. (23)
- Confident so that wingmen will trust lead. (23) (29)
- Methodical, logical, and predicable, so that wingmen can figure out what lead is going to do next. (29)
- Can accomplish quality training without "wasting the flight members' day or beating the subject to death." (19)
- Looks for the 90% solution to a problem. (19)
- Confident. (33)
- Focused and knows what is going on. (33)
- Always has smooth flights. (33)
- Knows the experience level, currency, and needs of the people in the flight, so he can determine what to accomplish. (34)
- Maintains positive flight lead control, while still encouraging wingmen to think for themselves. (34)

Attitudes on characteristics of effective wingmen

- Maintains "contract" in the air (position, visual, radios, radar). (1) (6) (7) (9) (10) (11) (13) (24) (25) (27) (29) (30) (35)
- Stays ahead of things. (1) (14) (24)
- Good listener. (2) (3) (12) (24) (32) (34)
- Can take constructive criticism. (3) (24)
- Knowledgeable. (3) (14)
- Good follower. (6) (12) (23)
- Willing to speak up when necessary. (5) (6) (8) (12) (14) (21) (24) (26) (27) (30) (34) (35)
- Motivated to learn and do well. (10) (18) (23) (31) (33) (34)
- Good situational awareness. (7) (10) (29) (30)
- Knows his role and position in the flight. (1) (2)
- Thorough; thinks through the entire mission. (2)
- Confident. (2)
- Aggressive ("but that's a fine line...."). (3)
- Good task prioritization—knows what is important. (4) (6)
- Will fly the plan. (12)
- Not worried about what lead is going to think or say. (12)

- Ready to fly. (24)
- Ready to assist the flight lead. (24)
- Backs up the flight leader. (25)
- Does not say anything until it is really needed. (25)
- Do what you are told to do. (5)
- Do your tasks well so that the flight lead will trust you and not have to worry about you. (5)
- Someone who does not talk all the time, but does when it is important to talk. (5) (21)
- Do not be a blind follower; help with rest of four-ship. (7)
- Backup flight lead/element lead. (9)
- "Keep focus on the big picture, not just looking through a soda-straw."(9)
- Be a help, not a hindrance." (10)
- Knows what's going on and how to fly the airplane. (11)
- Tries to think what the flight lead is thinking about. (30)
- Understands the plan and is able to execute the plan, or communicate it if he cannot. (8)
- Someone who continues to fly as if they are still being graded, even after their MR check. (20)
- Someone who is not intimidated by a flight lead. (20)
- Someone who gets into the books and asks questions. (20)
- Technically competent at basic level. (23)
- Has qualities to be a good flight leader. (33)
- Remembers the contracts and executes them. (34)